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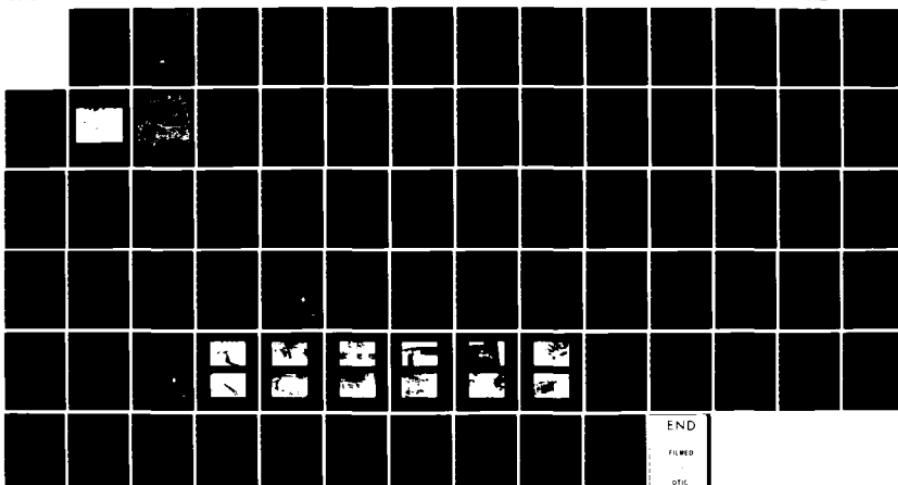
NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS
GUILFORD LAKES UPPER (U) CORPS OF ENGINEERS WALTHAM MA
NEW ENGLAND DIV JUN 81

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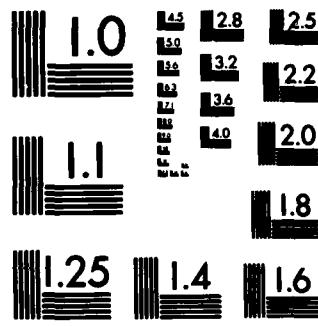
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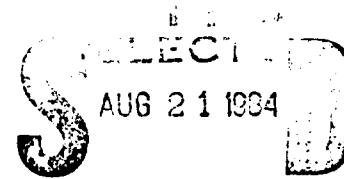
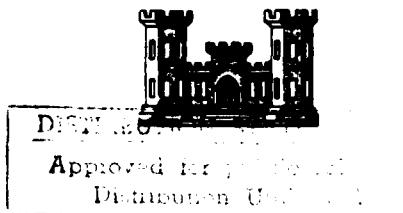
CONNECTICUT COASTAL BASIN
GUILFORD, CONNECTICUT

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GUILFORD LAKES UPPER DAM
CT. 00412

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

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DEPARTMENT OF THE ARMY

NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS.

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JUNE 1981

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SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER CT 00412	2. GOVT ACCESSION NO. ADA144564	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) Guilford Lakes Upper Dam		5. TYPE OF REPORT & PERIOD COVERED INSPECTION REPORT
NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS		6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) U.S. ARMY CORPS OF ENGINEERS NEW ENGLAND DIVISION		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS DEPT. OF THE ARMY, CORPS OF ENGINEERS NEW ENGLAND DIVISION, NEEDED 424 TRAPELO ROAD, WALTHAM, MA. 02254		12. REPORT DATE June 1981
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18. SUPPLEMENTARY NOTES Cover program reads: Phase I Inspection Report, National Dam Inspection Program; however, the official title of the program is: National Program for Inspection of Non-Federal Dams; use cover date for date of report.		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) DAMS, INSPECTION, DAM SAFETY, Connecticut Coastal Basin Guilford, Connecticut		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) Guilford Lakes Upper dam is a 200 foot long earthfill structure. The maximum height of the dam is 12 feet. The dam is classified as SMALL in size and a HIGH hazard structure in accordance with recommended guidelines established by the Corps of Engineers. Based on the size and hazard classification, the adopted test flood for this structure is equal to $\frac{1}{2}$ the PMF. Based on a visual inspection at the site, the dam is considered to be in FAIR condition.		

AUG 21 1981

NEDED

Honorable William A. O'Neill

I approve the report and support the findings and recommendations described in Section 7, with qualifications as noted above. I request that you keep me informed of the actions taken to implement these recommendations since this follow-up is an important part of the program.

Copies of this report have been forwarded to the Department of Environmental Protection and to the owner, Guilford Lakes Improvement Association, Guilford, CT. Copies will be available to the public in thirty days.

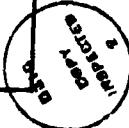
I wish to thank you and the Department of Environmental Protection for your cooperation in this program.

Sincerely,



WILLIAM E. HODGSON, JR.
Colonel, Corps of Engineers
Acting Commander and Acting Division Engineer

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DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM, MASSACHUSETTS 02254

REPLY TO:
ATTENTION OF:

NEDED

AUG 21 1981

Honorable William A. O'Neill
Governor of the State of Connecticut
State Capitol
Hartford, Connecticut 06115

Dear Governor O'Neill:

Inclosed is a copy of the Guilford Lakes Upper Dam (CT-00412) Phase I Inspection Report, prepared under the National Program for Inspection of Non-Federal Dams. The report is based upon a visual inspection, a review of past performance, and a preliminary hydrological analysis.

The preliminary hydrologic analysis indicated that the spillway capacity for the Guilford Lakes Upper Dam would likely be exceeded by floods greater than 7 percent of the Probable Maximum Flood (PMF). Our screening criteria specifies that a dam classified as high hazard with a spillway capacity insufficient to discharge fifty percent of the PMF be judged as having a seriously inadequate spillway. As a result, this dam is assessed as unsafe, non-emergency, until more detailed studies prove otherwise or corrective measures are completed.

The term "unsafe" applied to a dam because of an inadequate spillway does not indicate the same degree of emergency as that term would if applied because of structural deficiency. It does indicate, however, that a severe storm may cause overtopping and possible failure of the dam, with significant damage and potential loss of life downstream.

We recommend that within twelve months from the date of this report the owner of the dam engage the services of a qualified registered engineer to determine further the potential of overtopping the dam and the need for and the means to increase project discharge capacity. Based on this determination, appropriate remedial mitigating measures should be designed and completed within 24 months of this date of notification. In the interim a detailed emergency operation plan and warning system should be promptly developed and round-the-clock surveillance should be provided during periods of heavy precipitation or high project discharge.

GUILFORD LAKES UPPER DAM

CT 00412

CONNECTICUT COASTAL BASIN

GUILFORD, CONNECTICUT

PHASE 1 INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

NATIONAL DAM INSPECTION REPORT

PHASE 1 INSPECTION REPORT

IDENTIFICATION NO: CT 00412
NAME OF DAM: Guilford Lakes Upper Dam
COUNTY AND STATE: New Haven County,
Connecticut
STREAM: Iron Stream
DATE OF INSPECTION: 21 May 1981

Brief Assessment

Guilford Lakes Upper dam is a 200 foot long earthfill structure. The earth embankment has vertical walls on the upstream and downstream faces, and has a crest width of 26 feet. The upstream face is a grouted masonry wall and the downstream face is dry masonry. The dam has two adjacent spillways, a low level outlet, and an emergency overflow. The left spillway is 17 feet long, has a crest elevation of 54.9 NGVD and has a trapezoidal weir. The right spillway has a broadcrested weir, is 13 feet long, and has a crest elevation 55.0 NGVD. The emergency overflow consists of two 15 inch VC pipes passing through the dam near the left abutment. The upstream invert of the overflow is 55.5 NGVD. The maximum height of the dam is 12 feet. The low level outlet consists of two 24 inch diameter vitrified clay pipes controlled by manually operated sluice gates. The dam has an impoundment capacity of 83 acre-feet at the top of dam elevation of 58.3 NGVD and is used for recreation.

The dam is classified as SMALL in size and a HIGH hazard structure in accordance with recommended guidelines established by the Corps of Engineers. Based on the size and hazard classifications, the adopted test flood for this structure is equal to one-half the Probable Maximum Flood (PMF) which is estimated to be 425 CSM, or 4,420 CFS, from the 10.4 square mile drainage basin. This test flood has a routed outflow discharge equal to 4,370 CFS and would overtop the dam by 3.0 feet. The maximum spillways and emergency overflow capacity is equal to 635 CFS which represents 14% of the test flood outflow.

Based on a visual inspection at the site, the dam is considered to be in FAIR condition. However, there are several areas of concern which must be corrected to assure the long-term performance of this dam. It is recommended that the owner engage the services of a registered engineer experienced in the design of dams to accomplish the following:

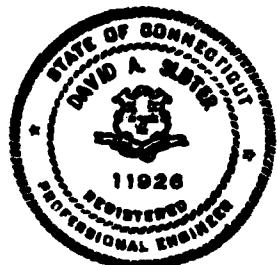
1. Perform a detailed hydrologic/hydraulic investigation to assess further the need for and the means to increase project discharge capacity and the ability of the dam to withstand overtopping;
2. Recommend methods to repair or seal the crushed left overflow pipe;
3. Provide procedures for removal of brush, trees and root systems to a distance of 15 ft downstream from the dam, and select soils to refill any resulting holes.

These and other recommendations and remedial measures as described in Section 7 should be implemented by the owner within one year after receipt of this Phase 1 Inspection Report.

NEW ENGLAND ENGINEERING, INC.

BY:

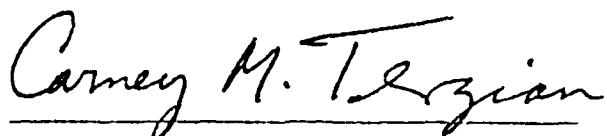
David A. Sluter
David A. Sluter, P.E.
President



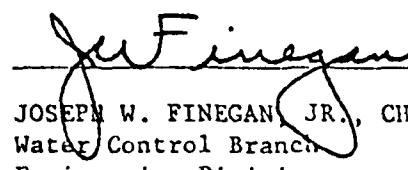
This Phase I Inspection Report on Guilford Lakes Upper Dam (CT-00412) has been reviewed by the undersigned Review Board members. In our opinion, the reported findings, conclusions, and recommendations are consistent with the Recommended Guidelines for Safety Inspection of Dams, and with good engineering judgement and practice, and is hereby submitted for approval.



ARAMAST MAHTESLAN, MEMBER
Geotechnical Engineering Branch
Engineering Division

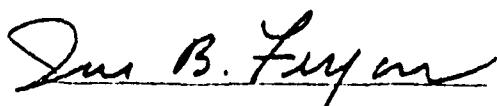


CARNEY M. TERZIAN, MEMBER
Design Branch
Engineering Division



JOSEPH W. FINEGAN, JR., CHAIRMAN
Water Control Branch
Engineering Division

APPROVAL RECOMMENDED:



JOE B. FRYAR
Chief, Engineering Division

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase 1 Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, DC 20314. The purpose of a Phase 1 Investigation is to identify expeditiously those dams which may pose hazards to human life or to property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigations, testing, and detailed computational evaluations are beyond the scope of a Phase 1 investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

Phase 1 inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test Flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonable possible storm runoff), or fractions thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the test flood should not be interpreted as necessarily posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition, and the downstream damage potential.

The Phase 1 Investigation does not include an assessment of the need for fences, gates, no-trespassing signs, repairs to existing fences and railings and other items which may be needed to minimize trespass and provide greater security for the facility and safety to the public. An evaluation of the project for compliance with OSHA rules and regulations is also excluded.

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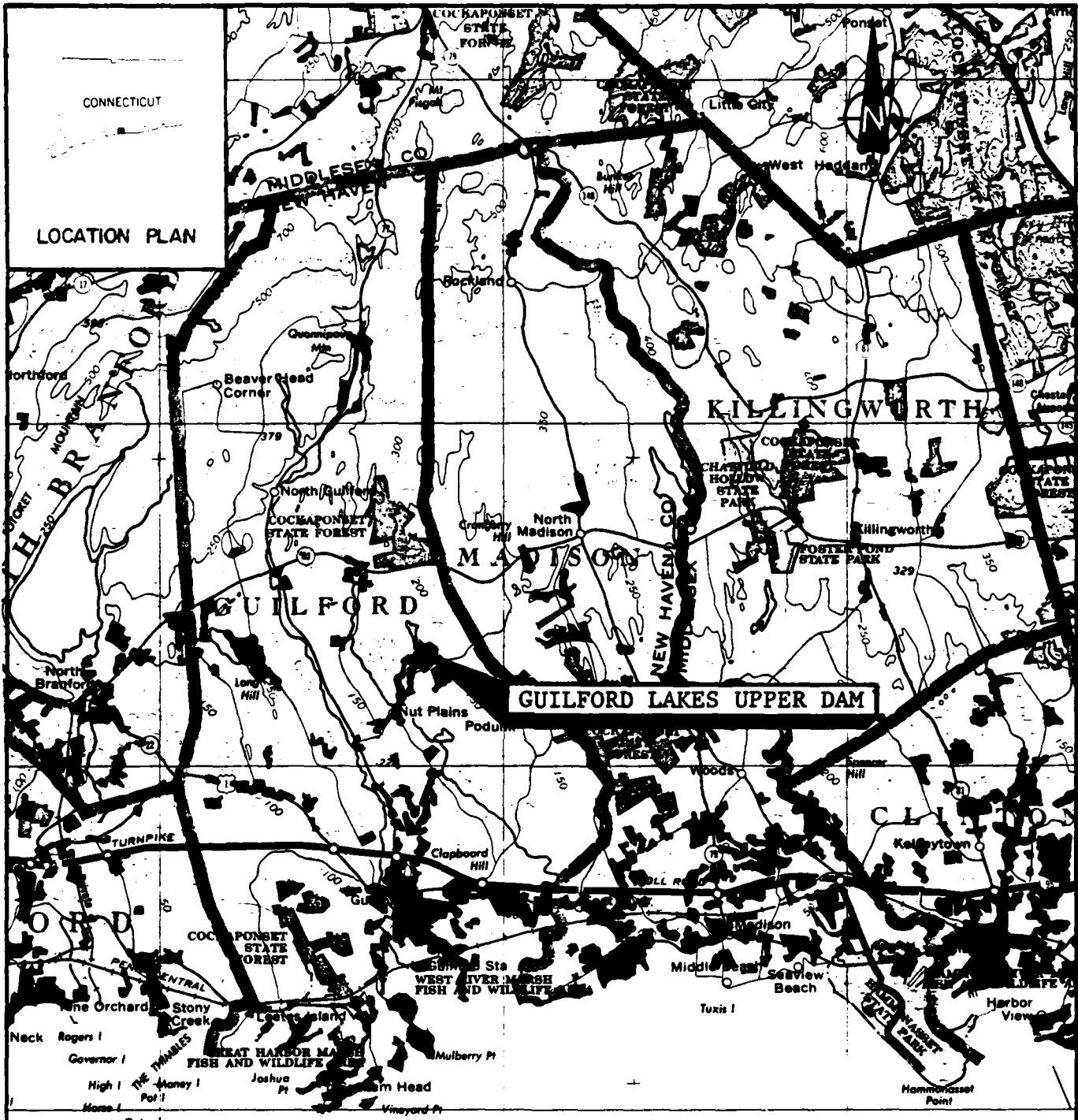
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OVERVIEW PHOTO - Guilford Lakes Upper Dam

May 21, 1981



LOCATION PLAN
GUILFORD LAKES UPPER DAM
Scale: 1" = 2 miles

Plate No. 1

NATIONAL DAM INSPECTION PROGRAM

PHASE 1 - INSPECTION PROGRAM

GUILFORD LAKES UPPER DAM

SECTION 1

PROJECT INFORMATION

1.1 General

a. Authority. Public Law 92-367, August 8, 1972, authorized the Secretary of the Army through the Corps of Engineers to initiate a national program of dam inspection throughout the United States. The New England Division of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within the New England Region. New England Engineering, Inc. has been retained by the New England Division to inspect and report on selected dams in the State of Connecticut. Authorization and notice to proceed was issued to New England Engineering, Inc. under a letter from William E. Hodgson, Jr., Colonel, Corps of Engineers. Contract No. DACW33-81-C-0007 has been assigned by the Corps of Engineers for this work.

b. Purpose of Inspection

1. Perform technical inspection and evaluation of non-Federal dams to identify conditions which threaten the public safety and thus permit correction in a timely manner by non-Federal interests.
2. Encourage and assist the State to initiate quickly effective dam safety programs for non-Federal dams.
3. To update, verify, and complete the National Inventory of Dams.

1.2 Description of the Project

a. Location. Guilford Lakes Upper Dam is located in Guilford, New Haven County, Connecticut on Iron Stream approximately 4 miles north of Interstate 95. Coordinates of the dam are approximately 41 degrees, 20.2' North Latitude, and 72 degrees, 40.9' West Longitude as shown on the Guilford USGS Quadrangle Sheet. The dam impounds water from Iron Stream which drains a 10.4 square mile watershed of rolling, wooded terrain. The axis of the reservoir is oriented in a North-South direction with the dam at the southern extremity of the reservoir.

b. Description of Dam and Appurtenances. Guilford Lakes Upper Dam is an earthfill structure approximately 200 feet long with a maximum height of 12 feet. The earth embankment has vertical upstream and downstream faces. The upstream face is a grouted masonry wall and the downstream face is dry masonry. The dam has two concrete spillways and an emergency overflow. The left spillway is 17 feet long and has a trapezoidal weir with a crest elevation of 54.9 NGVD. The right spillway is 13 feet long and has a broadcrested weir with a crest elevation of 55.0 NGVD. An emergency overflow which consists of two 15 inch diameter VC pipes passes through the dam near the left abutment. The upstream invert of the emergency overflow is 55.5 NGVD.

The low level outlet is located at the right spillway and consists of two 24 inch diameter VC pipes which pass through the spillway. The outlet is controlled by two vertical lift, hand operated sluice gates.

The dam crest also serves as a roadway for most of its length. The roadway is paved and 15 feet wide as shown in Appendix D. A 15 foot wide wood plank bridge passes over the spillway discharge channels approximately 9 feet downstream of the upstream face of the dam.

c. Size Classification. This dam has an impoundment capacity of 83 Ac-Ft at the top of the dam (elevation 58.3 NGVD) and a maximum height of 12 feet. In accordance with the guidelines established by the Corps of Engineers, this dam is classified as SMALL in size based on its impoundment capacity. Corps of Engineers guidelines specify that dams with impoundment capacities less than 1,000 Ac-Ft and greater than or equal to 50 Ac-Ft or a height of less than 40 feet and greater than or equal to 25 feet be classified as SMALL in size.

d. Hazard Classification. This dam is classified a HIGH hazard potential because its failure could result in a loss of more than a few lives and inundation of 2 homes located 200 feet downstream of the dam. It is estimated that a dam failure discharge of 3,630 CFS could produce a depth of flooding of 2-3 feet in the first house downstream and 1-2 feet in the second house downstream. The dam failure discharge was computed assuming the water level in the reservoir to be equal to the top of dam elevation of 58.3 NGVD at the time of failure. There would be no inundation of the houses at the prefailure discharge of 640 CFS (with the outlet closed).

- e. Ownership. The dam is presently owned by the Guilford Lakes Improvement Association, C/O Mr. Alexander Martins, Jr., 37 Middle Road, Guilford, CT 06437.
- f. Operator. The dam and gates are operated by the Guilford Lakes Improvement Association Dam Committee: Mr. Alexander Martins, Jr., Telephone number: (203)453-5543.
- g. Purpose of the Dam. The dam is used for recreation.
- h. Design and Construction History. The dam was reportedly constructed in 1929 as a part of a residential development project. The low level outlet was added in 1972. No records of the original construction or subsequent modifications are available.
- i. Normal Operating Procedures. The level of the reservoir is not normally controlled except in the spring and fall. The outlet gates are fully opened in the late fall each year and closed again after the spring runoff.

1.3 Pertinent Data

- a. Drainage Area. the Guilford Lakes Upper Dam drainage basin is generally rectangular in shape with an average length of approximately 5 miles, a width of 2 miles and a total drainage area of 10.4 square miles (See Appendix D for the basin map). Approximately 15 percent of the basin is man-made or natural storage. The topography consists of rolling terrain with elevations ranging from a high of 450 feet to 55 feet at the spillway crest. Basin slopes are considered moderate.
- b. Discharge at Damsite. There are no discharge records available for this dam. Calculated discharge data for the dam is listed below.

1. Outlet Works

Conduit & Size	2-24 inch diameter VC pipes Invert = 50.0 feet NGVD.
----------------	---

Discharge Capacity with reservoir at spillway crest eleva- tion = 55.0	70 CFS
---	--------

	Discharge Capacity with reservoir at top of dam elevation =	
	58.3	80 CFS
	Discharge Capacity at test flood elevation =	
	61.3	100 CFS
2.	Maximum known flood at damsite	Unknown
3.	Ungated spillway and emergency overflow capacity at top of dam	635 CFS
4.	Ungated spillway and emergency overflow capacity at test flood elevation	1,635 CFS
5.	Gated spillway capacity at normal pool eleva- tion	N/A
6.	Gated spillway capacity at test flood elevation	N/A
7.	Total spillway and emergency overflow capacity at test flood elevation	1,635 CFS
8.	Total project discharge at top of dam	715 CFS
9.	Total project discharge at test flood elevation	4,370 CFS

c. Elevations (NGVD)

1. Streambed at toe of dam 46.3
2. Bottom of cutoff Unknown
3. Maximum tailwater Unknown
4. Normal pool 55.0
5. Full flood control pool N/A
6. Spillway crest
 - a. Left spillway 54.9
 - b. Right spillway 55.0

7.	Emergency overflow invert	55.5
8.	Design surcharge (Original Design)	Unknown
9.	Top of dam	58.3
10.	Test flood	61.3

d. Reservoir Lengths (in feet)

1.	Normal pool	2,200
2.	Flood control pool	N/A
3.	Spillway crest pool	2,200
4.	Top of dam	2,200
5.	Test flood pool	2,200

e. Storage (acre-feet)

1.	Normal pool	50
2.	Flood control pool	N/A
3.	Spillway crest pool	50
4.	Top of dam	83
5.	Test flood pool	113

f. Reservoir Surface Area (Acres)

1.	Normal pool	10
2.	Flood control pool	N/A
3.	Spillway crest	10
4.	Top of dam	10
5.	Test flood pool	10

g. Dam

1.	Type	Earth embankment
2.	Length	200 feet
3.	Height	12 feet maximum
4.	Top width	26 feet

5.	Side slopes	Vertical
6.	Zoning	None
7.	Impervious Core	Unknown
8.	Cutoff	Unknown
9.	Grout Curtain	Unknown
10.	Other	No comment
h.	<u>Diversion and Regulating Tunnel</u>	N/A
i.	<u>Spillway</u>	
1.	Type	
a.	Left spillway	Trapezoidal weir
b.	Right spillway	Broadcrested weir
2.	Length of Weir	
a.	Left spillway	17.0 feet
b.	Right spillway	13.0 feet
3.	Crest Elevation	
a.	Left spillway	54.9 feet
b.	Right spillway	55.0 feet
4.	Gates	None
5.	U/S Channel	Natural bed of reservoir
6.	D/S Channel	Natural stream
7.	General	No comment
j.	<u>Emergency Overflow</u>	
1.	Type	Twin 15" VC pipes
2.	Invert elevation	55.5 upstream, 55.2 downstream
3.	Gates	None

k. Regulating Outlet

- | | |
|----------------------|--|
| 1. Invert | 50.0 |
| 2. Size | 2-24 inch diameter pipes |
| 3. Description | Vitrified Clay pipes |
| 4. Control mechanism | Manually operated, vertical lift sluice gate |

SECTION 2
ENGINEERING DATA

2.1 Design

There is no available documentation regarding the design of this facility.

2.2 Construction

No records of the original dam construction or subsequent repairs and modifications are available. Inspections were performed and a status report was prepared for the dam by Donald T. Ballou, Professional Engineer, in 1978. A copy of this report is included in Appendix B.

2.3 Operation

No operational records are maintained. The level of the lake is not generally controlled.

2.4 Evaluation

- a. Availability. There is no design information available.
- b. Adequacy. The lack of in-depth engineering data did not allow for a definitive review. Therefore, the adequacy of this dam could not be assessed from the standpoint of reviewing design and construction data, but is based primarily on visual inspection, past performance and sound engineering judgement.
- c. Validity. No design data is available.

SECTION 3
VISUAL INSPECTION

3.1 Findings

- a. General. The Phase 1 visual inspection of the Guilford Lakes Upper Dam was conducted on May 21, 1981 by representatives of New England Engineering, Inc. and Geotechnical Engineers, Inc. A visual checklist and photographic record of that inspection have been included in Appendix A and C, respectively, of this report. At the time of the inspection, the water level was at the spillway crest elevation of 55.0 NGVD.

Based on the visual inspection, the dam is judged to be in FAIR condition.

- b. Dam. The dam is a 200 foot long earthfill structure with vertical stone masonry faces. The crest has a width of 26 feet and serves as a roadway for most of its length. There are two spillways and an emergency overflow which is located near the left abutment. The left spillway is 17 feet long and the right spillway is 13 feet long. The low level outlet is located at the right spillway and consists of two 24 inch diameter VC pipes controlled by vertical lift sluice gates.

1. Upstream Face. The upstream face is a vertical grouted stone masonry wall which has a slight downstream curvature to the right of the spillways as shown in Photo C-12. It is possible that this curvature is due to ice pressure. The curvature is of no immediate concern, however, it should be observed at least annually to determine if any changes are occurring. The mortared stone masonry has numerous hairline cracks throughout its length.

2. Crest. The crest of the dam serves as a roadway for most of its length as shown in Photo C-1 and C-2. There are two 6 inch deep depressions in the crest located to the left of the spillway near the upstream face at stations 0+34 and 0+44. These depressions are less than 2 feet in diameter and may have been caused by runoff from the road seeping down through the embankment and into the cracks in the upstream face. These depressions should be excavated and filled with filter material to avoid further erosion. The remainder of the crest is in good condition.

The dam has reportedly been overtopped on several occasions in the past and the crest has been eroded. Consideration should be given to providing erosion protection for the grassed areas of the crest.

3. Downstream Face and Toe. The downstream face and toe are shown on Photos C-3 and C-4. The downstream face is a dry stone masonry wall in fair to good condition. Brush and trees to 24 inches in diameter are growing immediately downstream from the downstream face. The brush, trees and their root systems should be removed to a distance of 15 feet downstream to prevent future damage to the wall and to facilitate proper inspection by the downstream area.

A zone of ponded, stagnant water was observed about 25 feet downstream at Station 0+85. Its elevation was a few inches above the water in the nearby stream channel. In an inspection report by Donald T. Ballou, dated August 25, 1978, the author mentioned a leak (the quantity and turbidity were not reported) that was present on March 31, April 21, May 9 and June 16 but was dry on July 2 and August 20. This leak may still be present intermittently and may explain the stagnant water. Since the present inspection was made during a year of low rainfall, the seep may not have developed. The recommended action of Mr. Ballou to inspect this location periodically, particularly during high water and heavy rainfall, should be carried out. A copy of this report is included in Appendix B.

- c. Appurtenant Structures. Locations of the appurtenant structures are shown on the General Plan in Appendix B.

1. Spillways. The spillways are located 50 feet to the right of the left abutment. The left spillway has a trapezoidal weir, is 17 feet long and has a crest elevation of 54.9 NGVD. The right spillway has a broadcrested weir, is 13 feet long and a crest elevation of 55.0 NGVD (Photos C-5 and C-6). The spillway discharge channels pass under a wood plank bridge 9 feet downstream and are divided by a concrete and stone masonry training wall (Photo C-6). A crack through this training wall between the spillways is shown in Photo C-9. Leakage through this wall from the left spillway discharge channel into the right spillway discharge channel is shown in Photo C-10.

Frost action will continue to open such cracks. The right training wall of the right spillway appears to have moved laterally to the left about 1 inch (into the spillway opening), probably due to frost action. This movement is likely to increase with time. The floor of the left spillway discharge channel is approximately 4 feet higher than the right spillway discharge channel. A floating log was trapped upstream of the right spillway at the low level outlet gate. There are several steel pins set in the crests of the two spillways which were apparently used for stoplogs at one time. These pins should be removed to prevent debris accumulation.

2. Low Level Outlet. The low level outlet is located at the right spillway and consists of two 24 inch diameter VC pipes. Flow through these pipes is controlled by manually operated, vertical lift sluice gates. The gate lift mechanisms were reported to be operable and appeared to be in good working order (Photo C-5). The outlet conduits were not visible because water was flowing over the spillway at the time of inspection.
 3. Emergency Overflow. The emergency overflow is located near the left abutment and consists of two 15 inch diameter VC pipes. The inlet and outlet of the overflow are shown on Photos C-7 and C-8 respectively. The left pipe is crushed and cannot pass flow. The right pipe has some accumulated debris and should be cleaned.
- d. Reservoir Area. No specific detrimental features in the reservoir area were observed during the visual inspection.
 - e. Downstream Channel. The downstream channel is the natural stream bed of the brook as shown on Photo C-11. The channel contains brush, small trees and loose rock which act as restrictions to flow.

3.2 Evaluation

Based on the visual inspection, the dam appears to be in FAIR condition. The following features could adversely affect the future performance of the dam and should be investigated:

- a. The minor erosion depressions in the crest.

- b. The cracks in training wall dividing the spillway discharge channels and the movement of the right training wall of the right spillway.
- c. The seepage reported by Ballou in 1978 at station 0+90.
- d. The trees and brush should be removed from the dam and to a distance of 15 feet downstream of the toe.

SECTION 4

OPERATIONAL AND MAINTENANCE PROCEDURES

4.1 Operational Procedures

- a. General. Guilford Lakes are used for recreation. Operational control is the responsibility of the dam committee of the Guilford Lakes Improvement Association. The reservoir level is seasonally controlled.
- b. Warning System. There is no formal warning system or emergency action plan for the dam. The outlet gates are reported to be opened by the dam operator, Mr. Alex Martins, Jr., in the event of a large storm.

4.2 Maintenance Procedures

- a. General. Maintenance of dam is performed as required. No regularly scheduled maintenance is performed.
- b. Operating Facilities. The low level outlet gates are fully opened each fall and closed again after the spring runoff. The lake level is not generally controlled during the remainder of the year.

4.3 Evaluation

- a. The facility receives minor maintenance as required. The outlet gates are not operated or lubricated regularly. The emergency overflow pipes require cleaning and repair.
- b. The root systems of small trees and brush which are growing at the toe immediately downstream of the earth embankment could cause a deterioration of the masonry wall and paths for seepage.
- c. There is no regularly scheduled maintenance for this dam. There are several maintenance deficiencies as described above. A systematic inspection and rehabilitation program should be developed and implemented.
- d. An emergency action plan should be developed and implemented that includes procedures to lower the reservoir level, locations of emergency equipment, materials or manpower to reduce or minimize dam failure damage, authorities to be contracted in emergency situations and a program of surveillance during unusual storm events.

SECTION 5

EVALUATION OF HYDRAULIC/HYDROLOGIC FEATURES

5.1 General

The Guilford Lakes Upper Dam was reportedly constructed in 1929 for recreation. The dam is located on the Iron Stream in the Connecticut Coastal Basin. The watershed for the reservoir is 10.4 square miles with approximately 15% of this basin man-made or natural storage.

The dam has a total spillway length of 30 feet and a maximum height of 12 feet. The total length of the dam is 200 feet including the spillway. The reservoir has a storage capacity at the spillway crest of 50 Ac-Ft. Each foot of depth above the spillway level can accommodate 10 Ac-Ft of water equivalent to 0.02 inches of runoff.

It will take about 2 hours to lower the reservoir 1 foot based on a surface area of 10 acres and an outflow of 70 CFS.

5.2 Design Data

Little specific data is available for this watershed or structure. In lieu of existing complete design information, U.S.G.S. topographic maps (scale 1" = 2,000') were utilized to develop hydrologic parameters such as drainage area, reservoir surface areas, basin slopes and other runoff characteristics. Elevation-storage relationships for the reservoir were approximated. Some of the pertinent hydraulic data was obtained or confirmed by actual field measurements at the time of the visual inspection. Test flood inflows and outflows and dam failure flows were determined in accordance with the Corps of Engineers guidelines.

5.3 Experience Data

No historical data or recorded discharges are available for this dam. The dam has reportedly been overtopped on several occasions in the past.

5.4 Test Flood Analysis

Recommended guidelines for the Safety Inspection of Dams by the Corps of Engineers were used for selection of the Test Flood. This dam is classified under those guidelines as a HIGH hazard and SMALL in size. Guidelines indicate that a flood equal to one-half the PMF to the full PMF be used as a range of test floods for such a classification. A test

flood equal to 1/2 the PMF was selected because the dam is on the low end of the size classification. The watershed has a total drainage area equal to 10.4 square miles of which approximately 15% is man-made or natural storage. This drainage area is sparsely populated, fairly wooded, with rolling topography.

A test flood value was selected from the Corps of Engineers PMF curve for a watershed with flat to rolling topography and reduced by 15% for storage within the watershed. The test flood inflow was calculated to be 425 CSM, equal to 4,420 CFS and was adopted for this analysis. The routed outflow discharge for the test flood inflow was 4,370 CFS. The spillway and outlet rating curves are illustrated in Appendix D. Flood routing was performed assuming a full reservoir at the spillway crest elevation of 55.0 NGVD and the outlet to be open.

The analysis indicated that the peak test flood outflow would overtop the dam by approximately 3.0 feet. The maximum outflow capacity of the spillways and emergency overflow at the top of dam elevation 58.3 is 635 CFS or 14% of the test flood.

5.5 Dam Failure Analysis

For this analysis a full-depth, partial-width breach was assumed to have occurred in this dam. The adopted breach width of 30 feet was based on the dam height and cross section. A dam failure discharge of 3,640 CFS was calculated assuming the reservoir level to be at the top of dam elevation 58.3. The dam failure discharge of 3,640 CFS includes a spillway and emergency overflow discharge of 640 CFS and will produce a depth of flooding of 6 feet at the toe of the dam. It is estimated that failure could result in the loss of more than a few lives and a flood wave with a depth of 5-6 feet above the channel at two homes located 200 feet downstream of the dam. The first house downstream of the dam would be flooded to a depth of 2-3 feet and the second house to a depth of 1-2 feet. Neither house would be flooded by the prefailure discharge of 640 CFS. The prime impact area that would be subject to damage if the dam were to fail has been delineated on the Dam Failure Impact Area Map in Appendix D. As a result of the failure analysis, the dam has been classified as a HIGH hazard structure.

SECTION 6

EVALUATION OF STRUCTURAL STABILITY

6.1 Visual Observations

Visual examination of the geotechnical and structural aspects of the dam do not indicate any immediate stability problems.

6.2 Design and Construction Data

No design or construction drawings or records for the original dam are available.

6.3 Post-Construction Changes

The low level outlet and gates were reportedly constructed in 1972. There are no plans or records available for that construction.

6.4 Seismic Stability

The dam is located in Seismic Zone 1 and, in accordance with recommended Phase 1 guidelines, does not warrant seismic stability analysis.

SECTION 7

ASSESSMENT, RECOMMENDATIONS AND REMEDIAL MEASURES

7.1 Dam Assessment

- a. Condition. Based on the visual inspection, this dam is judged to be in FAIR condition. Features which could adversely affect the condition of the dam in the future are:
 1. Trees and brush growing at the toe of the dam.
 2. Reported seepage near station 0+90 at the toe of the dam.
 3. Inadequate project discharge capacity.
- b. Adequacy of Information. The available information is such that the assessment of the condition of the dam must be based on visual observations.
- c. Urgency. The recommendations and remedial measures described below should be implemented by the owner within one year after receipt of the Phase 1 report.

7.2 Recommendations

The following items should be carried out under the direction of a qualified registered engineer and recommendations resulting should be implemented by the owner.

- a. Perform a detailed hydrologic/hydraulic investigation to assess further the need for and the means to increase project discharge capacity and the ability of the dam to withstand overtopping.
- b. Recommend methods to repair or seal the crushed left emergency overflow pipe.
- c. Prescribed methods for the removal of brush, trees and root systems, and replacement with compacted soil as recommended by the engineer.
- d. During high water and periods of heavy rainfall observe the apparent intermittent seep near station 0+90 on downstream side of dam. Also observed the seepage through the training wall separating the spillway discharge channels.

7.3 Remedial Measures

a. Operation and Maintenance Procedures

1. Develop an "Emergency Action Plan" that will include an effective preplanned downstream warning system, locations of emergency equipment, materials and manpower, authorities to contact and potential areas that require evacuation.
2. Observe movement of right training wall of right spillway and cracks and leaks in center training wall between spillways at least annually. Note condition and take action as needed.
3. Repair eroded holes at the upstream face at station 0+34 and 0+44 by excavating them and refilling with properly selected filter soil.
4. Remove the steel pins in the spillway crests.
5. Institute a program to record high water levels during periods of heavy precipitation.
6. Implement a regular maintenance program for the facility which includes cleaning debris from the emergency overflow.
7. Institute a program of annual technical inspection by a qualified registered engineer.

7.4 Alternatives

There are no practical alternatives to the recommendations and remedial measures discussed above.

APPENDIX A

INSPECTION CHECKLIST

1

VISUAL INSPECTION CHECKLIST
PARTY ORGANIZATION

PROJECT GUILFORD LAKES UPPER DAM

DATE May 21, 1981

TIME 0841-1130

WEATHER Fair 63°F.

W.S. ELEV. 55.15 U.S.49.5 DN.S.

PARTY:

1. David Sluter - NEE 6. _____
2. Steve Fodor - NEE 7. _____
3. Steve Poulos - GFI 8. _____
4. _____ 9. _____
5. _____ 10. _____

PROJECT FEATURE	INSPECTED BY	REMARKS
1. Geotechnical	Steve Poulos - GEI	
2. Structural, Hydraulics, Hydrolog	D. Sluter & S. Fodor - NEE	
3. _____		
4. _____		
5. _____		
6. _____		
7. _____		
8. _____		
9. _____		
10. _____		

PERIODIC INSPECTION CHECKLIST

PROJECT	<u>GUILFORD LAKES UPPER DAM</u>	DATE	<u>May 21, 1981</u>
PROJECT FEATURE	<u>Structural, H & H</u>	NAME	<u>Sluter, Fodor</u>
DISCIPLINE	<u>Geotechnical</u>	NAME	<u>Poulos</u>

AREA EVALUATED	CONDITION
<u>DAM EMBANKMENT</u>	
1 Crest Elevation	58.3
2 Current Pool Elevation	55.15
3 Maximum Impoundment to Date	Unknown
4 Surface Cracks	None observed.
5 Pavement Condition	Satisfactory. Grassed 6' wide upstream side of pavement.
6 Movement or Settlement of Crest	Crest of embankment slopes down to right 0" below crest at left. 12" below at right. Sta 0+34 and 0+44 there are two minor sinkholes 6-8" deep that may be drainage from road into pond.
7 Lateral Movement	Upstream face to right of spillway is out of line (due to ice pressure?) by 11", concave upstream.
8 Vertical Alignment	Satisfactory.
9 Horizontal Alignment	See 7.
10 Condition at Abutment and at Concrete Structures	Satisfactory.
11 Indications of Movement of Structural Items on Slopes	See 6. Right training wall of right spillway may have moved to left 1" or so due to frost action.
12 Trespassing on Slopes	Free access. (Slopes are vertical faces.)
13 Sloughing or Erosion of Slopes or Abutments	None. Minor trespass erosion on right side of spillway.
14 Rock Slope Protection - Riprap Failures	The upstream face is the riprap. Mortared stone masonry with numerous hairline cracks. Water leaks through during high water according to owner's representative.
15 Unusual Movement or Cracking at or Near Toe	None observed.
16 Unusual Embankment or Downstream Seepage	0+85 pool of stagnant water 25' downstream from toe on right side of stream
17 Piping or Boils	None observed.
18 Foundation Drainage Features	None.
19 Toe Drains	None.
20 Instrumentation System	None.
21 Vegetation	Grassed and paved on crest. Forested on downstream side. 26" maple adjacent to downstream face at 0+35. Other trees are up to 6" size.

PERIODIC INSPECTION CHECKLIST

PROJECT GUILFORD LAKES UPPER DAM DATE May 21, 1981
PROJECT FEATURE Structural, H & H NAME Sluter, Fodor
DISCIPLINE Geotechnical NAME Poulos

AREA EVALUATED	CONDITION
<p><u>DIKE EMBANKMENT</u></p> <p>Crest Elevation</p> <p>Current Pool Elevation</p> <p>Maximum Impoundment to Date</p> <p>Surface Cracks</p> <p>Pavement Condition</p> <p>Movement or Settlement of Crest</p> <p>Lateral Movement</p> <p>Vertical Alignment</p> <p>Horizontal Alignment</p> <p>Condition at Abutment and at Concrete Structures</p> <p>Indications of Movement of Structural Items on Slopes</p> <p>Trespassing on Slopes</p> <p>Sloughing or Erosion of Slopes or Abutments</p> <p>Rock Slope Protection - Riprap Failures</p> <p>Unusual Movement or Cracking at or Near Toes</p> <p>Unusual Embankment or Downstream Seepage</p> <p>Piping or Boils</p> <p>Foundation Drainage Features</p> <p>Toe Drains</p> <p>Instrumentation System</p> <p>Vegetation</p>	No dike.

4
PERIODIC INSPECTION CHECKLISTPROJECT GUILFORD LAKES UPPER DAMDATE May 21, 1981PROJECT FEATURE Structural, H & HNAME Sluter, FodorDISCIPLINE GeotechnicalNAME Poulos

AREA EVALUATED	CONDITION	
<u>OUTLET WORKS - INTAKE CHANNEL</u>	Slidegates at spill-way	Emergency overflow outlet on left end 2, 15 in. diameter pipes.
a. Approach Channel		
Slope Conditions	Gentle to moderate.	Gentle to moderate.
Bottom Conditions	Under water 6' deep. Bottom of pond.	Silted in to invert of pipes.
Rock Slides or Falls	None.	None.
Log Boom	None.	None.
Debris	Log & other debris in front of gates.	See below.
Condition of Concrete Lining	N/A.	Left pipe is crushed. Right pipe has 60% obstruction (log).
Drains or Weep Holes	N/A.	N/A.
b. Intake Structure	N/A.	N/A.
Condition of Concrete		
Stop Logs and Slots		

PERIODIC INSPECTION CHECKLIST

PROJECT GUILFORD LAKES UPPER DAMDATE May 21, 1981PROJECT FEATURE Structural, H & HNAME Sluter, FodorDISCIPLINE GeotechnicalNAME Poulos

AREA EVALUATED	CONDITION	
<u>OUTLET WORKS - CONTROL TOWER</u>	<u>Spillway outlet works</u>	<u>Emergency overflow outlet</u>
a. Concrete and Structural		
General Condition	Fair.	Twin 15" pipes. Left one crushed and plugged. Right one partially obstructed.
Condition of Joints		None.
Spalling		None.
Visible Reinforcing		None.
Rusting or Staining of Concrete		None.
Any Seepage or Efflorescence	See page 8 - Spillway	None.
Joint Alignment		N/A.
Unusual Seepage or Leaks in Gate Chamber		
Cracks		
Rusting or Corrosion of Steel		
b. Mechanical and Electrical		
Air Vents	None.	
Float Wells	None.	
Crane Hoist	None.	
Elevator	None.	
Hydraulic System	None.	
Service Gates	Fair. Operable (log in front).	
Emergency Gates	None.	
Lightning Protection System	None.	
Emergency Power System	None.	
Wiring and Lighting System	None.	

PERIODIC INSPECTION CHECKLIST			
PROJECT	GUILFORD LAKES UPPER DAM		
PROJECT FEATURE	Structural, H & H		
DISCIPLINE	Geotechnical		
AREA EVALUATED		CONDITION	
<u>OUTLET WORKS - TRANSITION AND CONDUIT</u>		NO GEOTECHNICAL FEATURES	
General Condition of pipes Rust or Staining on Concrete Spalling Erosion or Cavitation Cracking Alignment of Monoliths Alignment of Joints Numbering of Monoliths		Spillway outlet works	Emergency overflow outlet Discharge from gates goes through 2-24" v.c. pipes that pass through spillway weir. Not visible.  Horizontal and vertical displacement of joints in right conduit in range of 1 in.

7
PERIODIC INSPECTION CHECKLIST

PROJECT GUILFORD LAKES UPPER DAM DATE May 21, 1981
PROJECT FEATURE Structural, H & H NAME Sluter, Fodor
DISCIPLINE Geotechnical NAME Poulos

AREA EVALUATED	CONDITION
<u>OUTLET WORKS - OUTLET STRUCTURE AND OUTLET CHANNEL</u>	See spillway discharge channel for outlet from slidegates. This form is filled out for the emergency overflow.
General Condition of Concrete	Good.
Rust or Staining	N/A.
Spalling	N/A.
Erosion or Cavitation	N/A.
Visible Reinforcing	N/A.
Any Seepage or Efflorescence	N/A.
Condition at Joints	N/A.
Drain holes	None.
Channel	
Loose Rock or Trees Overhanging Channel	Forested.
Condition of Discharge Channel	Satisfactory for the flow from twin 15" pipes.

PERIODIC INSPECTION CHECKLIST

B

PROJECT GUILFORD LAKES UPPER DAMDATE May 21, 1981

D

PROJECT FEATURE Structural, H & HNAME Sluter, Fodor

H

DISCIPLINE GeotechnicalNAME Poulos

AREA EVALUATED	CONDITION
<u>OUTLET WORKS - SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS</u>	
a. Approach Channel	
General Condition	Under water.
Loose Rock Overhanging Channel	None.
Trees Overhanging Channel	None.
Floor of Approach Channel	Under water 5.5' deep at right spillway. 2.5' deep at left spillway.
b. Weir and Training Walls	
General Condition of Masonry	Stone wall grouted. Pointed on water side. Right training wall of right spillway apparently moved to left by frost action. Center previously cracked - hairline all the way through.
Rust or Staining	N/A.
Spalling	N/A.
Any Visible Reinforcing	N/A.
Any Seepage or Efflorescence	N/A.
Drain Holes	None.
c. Discharge Channel	
General Condition	Center training wall has leaks from high (left) spillway into right spillway discharge channel.
Loose Rock Overhanging Channel	Good. None.
Trees Overhanging Channel	Fully forested both sides.
Floor of Channel	Natural bouldery streambed.
Other Obstructions	None.
Other Comments	None.

PFRIODIC INSPECTION CHECKLIST

PROJECT GUILFORD LAKES UPPER DAM DATE May 21, 1981PROJECT FEATURE Structural, H & H NAME Sluter, FodorDISCIPLINE Geotechnical NAME Poulos

AREA EVALUATED	CONDITION
<u>OUTLET WORKS - SERVICE BRIDGE</u> a. Super Structure Bearings Anchor Bolts Bridge Seat Longitudinal Members Underside of Deck Secondary Bracing Deck Drainage System Railings Expansion Joints Paint b. Abutment & Piers General Condition of Concrete Alignment of Abutment Approach to Bridge Condition of Seat & Backwall	None.

APPENDIX B

ENGINEERING DATA

**GUILFORD LAKES UPPER DAM
GENERAL PLAN**

GENERAL PLAN

NO SCALE



GUILFORD UPPER LAKE

CONCRETE RETAINING WALL

ל-הנוטר אטונה מסוכני ו/or

— CRACK THROUGH TRAINING WALL

BRIGHT SPILLWAY **LEFT SPILLWAY**

卷之三

LOW LEVEL OUTLET

2-24" VC PIPE

PAVED ROAD

卷之三十一

תְּמִימָה תְּמִימָה תְּמִימָה תְּמִימָה

וְעַד פְּלָמָג בְּרוֹדִי -

DAY STONE MAGNETIC IRON

ATTACHMENT POOL —

•

D+50

१२

No. G 1
Inventoried
By NYC
Date 12-2-1962

WATER RESOURCES COMMISSION
SUPERVISION OF DAMS
INVENTORY DATA

17

37-412

Name of Dam or Pond GUILFORD LAKES (NYC PEC)

Code No. E 7.3

Nearest Street Location LAKESIDE DRIVE

Town GUILFORD

U.S.G.S. Quad. GUILFORD

Name of Stream EAST RIVER

Owner GUILFORD PROPERTIES INCORPORATED

Address GUILFORD

Pond Used For RECREATION

DA P-10300
13.0

Dimensions of Pond: Width 300 FEET Length 1700 FEET Area 12 ACRES

Total Length of Dam 40 FEET Length of Spillway 30 FEET

Location of Spillway CENTER OF DAM

Height of Pond Above Stream Bed 7 FEET

Height of Embankment Above Spillway 3 FEET

Type of Spillway Construction CONCRETE

Type of Dike Construction MASONRY

Downstream Conditions LOW IN RIVER AND LAKES

Summary of File Data _____

Remarks _____

DOUGLASS PARK, NEW YORK

Would Failure Cause Damage? NO Class X B

DONALD T. BALLOU
Professional Engineer

STATUS REPORT
ON
GUILFORD LAKES DAMS

FOR
Guilford Lakes Improvement Assoc.
% William Karnofsky
32 White Birch Drive
Guilford, Conn. 06437

Prepared by:

Donald T. Ballou

DONALD T. BALLOU

DTB

DONALD T. BALLOU
Professional Engineer

August 25, 1978

Guilford Lakes Improvement Assoc.
% William Karnofsky
32 White Birch Drive
Guilford, Conn. 06437

Re: Guilford Lakes Dams

Dear Bill:

Per my proposal dated 2/14/78 please find submitted herewith a report covering the present status of the Guilford Lakes Dams.

Please accept my apology for submitting the report later than we both anticipated.

The study proceeded rather well with an excellent opportunity for closer scrutiny of all three dams as a result of ten site visits from March thru August.

Approximately 100 color pictures were taken during the evaluation. The majority of these have been included with the report. If you would select the ones that you would like prints of I will see that you receive a set for your record.

The report was longer and more detailed than originally planned, but the various items evaluated and discussed had to be included in a report of this nature. Most of the items discussed should serve as a guide in future maintenance evaluations if your checklist does not already incorporate them.

DONALD T. BALLOU
Professional Engineer

Other than those items commented upon in the report all three dams appear to be in reasonably good condition as regards to the main structures, operating functions and normal maintenance.

It was my pleasure working with you and Bob McKernan during this investigation. Should there be any questions concerning any phase of the report please feel free to call.

Respectfully,

Donald T. Ballou

DONALD T. BALLOU

DONALD T. BALLOU
Professional Engineer

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DONALD T. BALLOU

Professional Engineer

General

The Guilford Lakes are situated in the western-central portion of town. They are oriented along a north-south axis with flow occurring in a southernly direction.

There are two lakes with a combined drainage area of 11.0 square miles, the upper lake draining 10.4 square miles of the 11.0.

The upper lake is fed primarily by Iron Stream and Dowds Hollow Brook watersheds. The upper lake outlets to the lower lake via a short reach of stream; the lower lake outlets to the East River above its confluence with Meadow Brook.

Purpose

To provide an evaluation of the Guilford Lakes Dams.

Scope

The evaluation of the dams included field inspection during the months of March thru August for visual indications of leakage, boils, piping, sloughing and general structural condition.

DONALD T. BALLOU
Professional Engineer

COMMENTARY

Upper Lake Dam

General

The dam is approximately 140 feet in length, 24 feet in width and about 9 feet high above streambed. It is oriented on an east-west axis and has Lakeside Drive running across the top of it. Where the road crosses the central portion of the dam a bridge of 3" thick oak planking is utilized as there are two spillways that pass underneath.

The dam itself is composed of an upstream wall of rubble masonry with earth embankment forming the downstream portion. The downstream face of the earth embankment is supported with a dry rubble wall. The lower upstream face of the masonry wall appears to have had a concrete footing poured against it; probably many years after initial construction of the dam.

The central portion of the dam has two overflow spillways that pass underneath Lakeside Drive. The entrance to the westernmost spillway is 12'-6" wide and 3'-3" high. The entrance to the easternmost spillway is 15'-3" wide and 3'-2" high. The length of the spillways is approximately 24 feet. Both spillways have provisions for adding flashboards during low flow periods.

There are two 24" diameter clay pipes in the lower portion of the western spillway. These pipes have slide gates at their upstream end that are used to either control flow passing over

DONALD T. BALLOU

Professional Engineer

the dam or to drain the lake during periods of required maintenance. The slide gates are normally in the closed position.

At the easternmost end of the dam is located a bypass which consists of two 15" diameter clay pipes. These pipes run underneath the road and exit at the downstream face of the dam. These pipes apparently serve the function of bypassing some of the excess water should the spillways carry a surcharge somewhere in the range of what would pass over the flashboards.

Observations & Comments

The entire downstream face of the dam in all inspections showed no signs of leakage except for one spot at the toe located about 15 feet west of the edge of the exit to the westernmost spillway. This appeared as a wet spot on March 31. On April 21 there was a slight seepage from this location. On May 9 the seepage still remained the same. On June 16 the seepage had decreased. On July 2 and August 20 the seepage had stopped and the area appeared dry. I would not place any undue concern over what appears to be a minor and intermittent seepage; however, at the same time, you should periodically check this point along with your normal maintenance checks. A great number of small dams exhibit minor seepage at the downstream toe for decades without indicating any harmful effects.

DONALD T. BALLOU
Professional Engineer

The masonry wall that runs along the upstream face of the dam has been parged but still reflects numerous discontinuities (joint separation) along its length. These appear to be primarily on the western side of the dam which could very well be a result of vehicular contact.

The discontinuities should be refurbished by standard masonry methods. The visual affects are probably more detrimental than the structural aspects at this point in time; however, freeze-thaw cycles will eventually increase the quantity and intensity of the discontinuities.

The rubble-masonry walls that form the sides of the two spillways, especially upstream of the bridge, show several areas of discontinuities; these should also be refurbished. These walls also reflect a loss of the masonry binder in areas of the middle and lower portions; once again, upstream of the bridge. The effect of the loss of the masonry binder is that water courses thru and between the existing stone rubble and surfaces at lower levels of the wall. This condition gives a visual impression of an unsafe situation. While I would not be overly concerned at this time I would certainly take the necessary action to restore the walls to a condition such that the water will not course thru the interior portions. Once again a standard masonry treatment of packing or grouting

DONALD T. BALLOU

Professional Engineer

would appear to be a reasonable approach to correcting the situation. Pargeting afterwards would also be helpful.

It is quite possible that the above recommended treatment may still not resolve the water showing up at the middle and lower portions of the spillway walls. If this is the case then you might want to consider a method of treatment whereby a reinforced concrete wall of about 6" thickness is formed and poured against the upstream face of the dam that extends several feet beyond the spillways and rises from the bottom of the upstream face to a level near the crest of the spillways. This method of facing should close off access to water that is passing thru the walls.

The main spillways that lie primarily under the bridge exhibit minor spalling along the edges with some wearing away of concrete on the inverts. This is to be expected in any spillway with this type of construction and is not cause for alarm. Patching in these areas would be helpful and may be accomplished at your convenience.

Summary

As an overall comment, other than those points discussed above, the dam appears to be in reasonably good condition. Regardless of the present age of the dam it would appear that this structure will yield many more years of useful service.

APPENDIX C

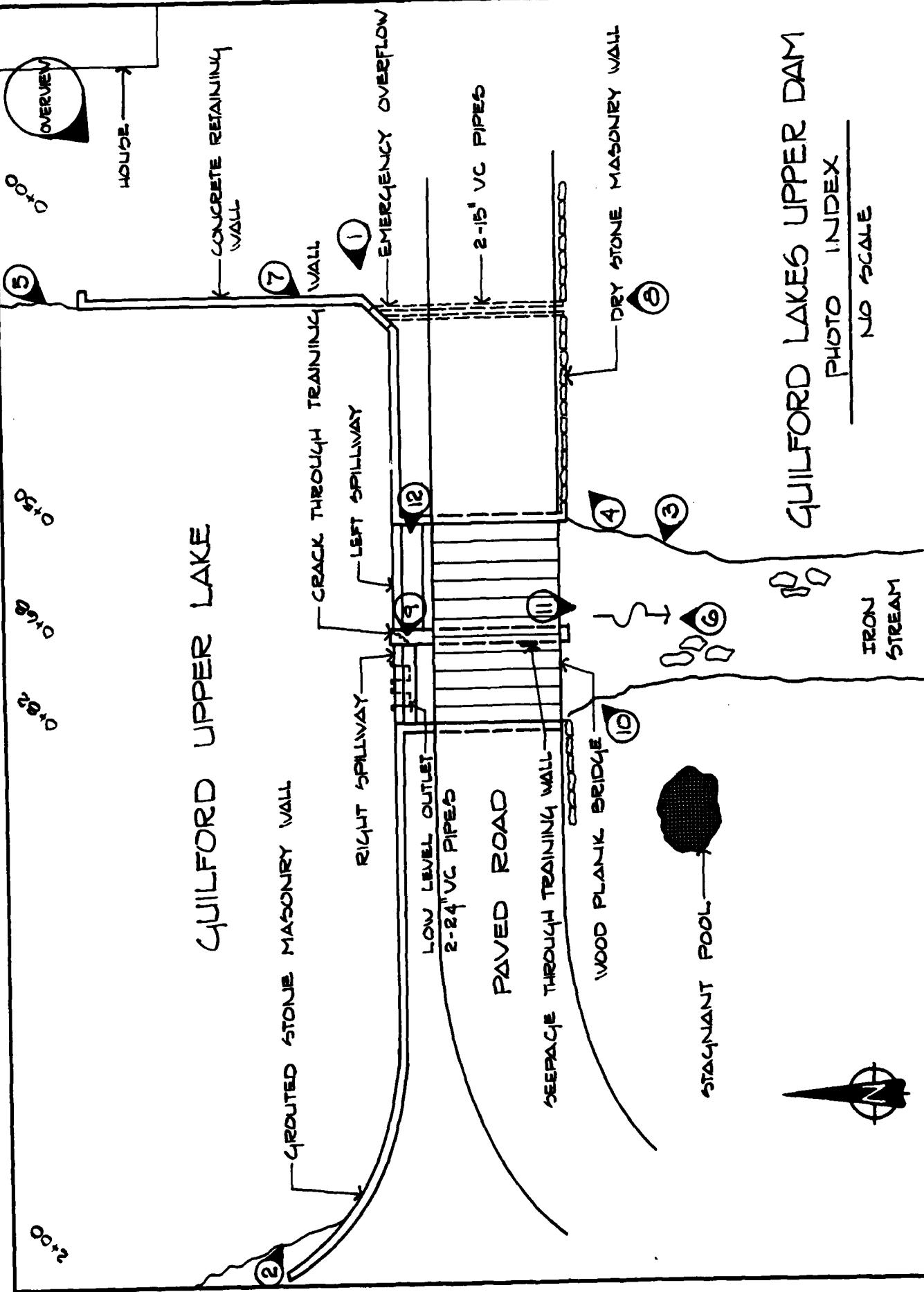
PHOTOGRAPHS

GUILFORD LAKES UPPER DAM

PHOTO INDEX

NO SCALE

GUILFORD UPPER LAKE



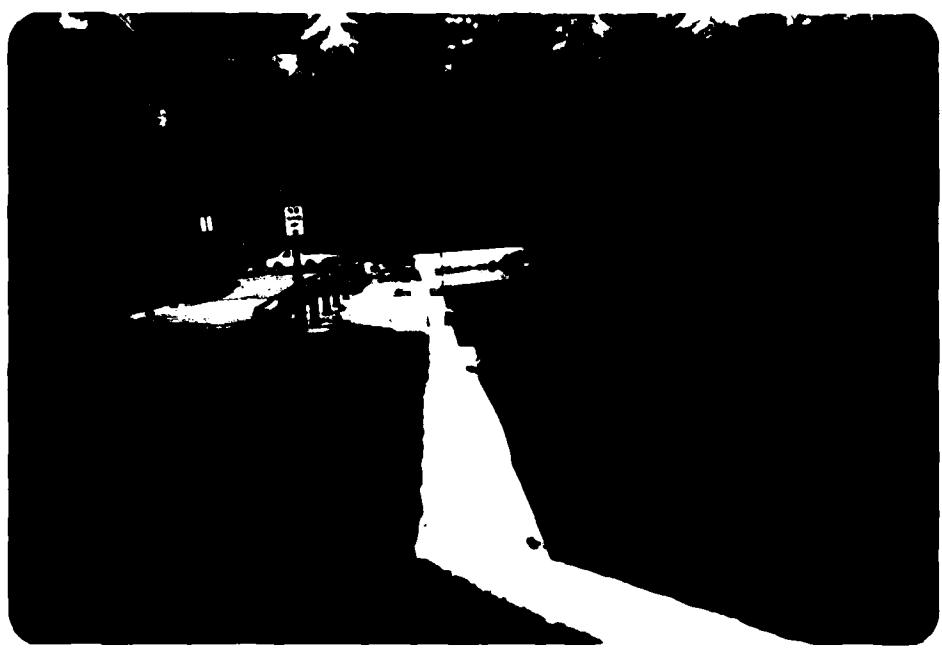


PHOTO C-1. Crest of the dam from the left abutment.

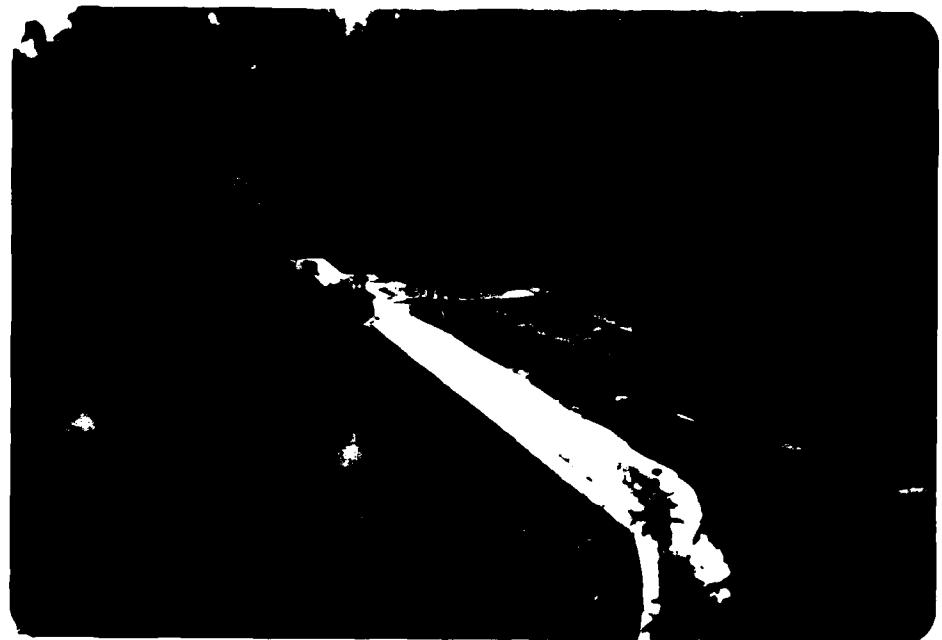


PHOTO C-2. Upstream face and crest of the dam
from the right abutment.

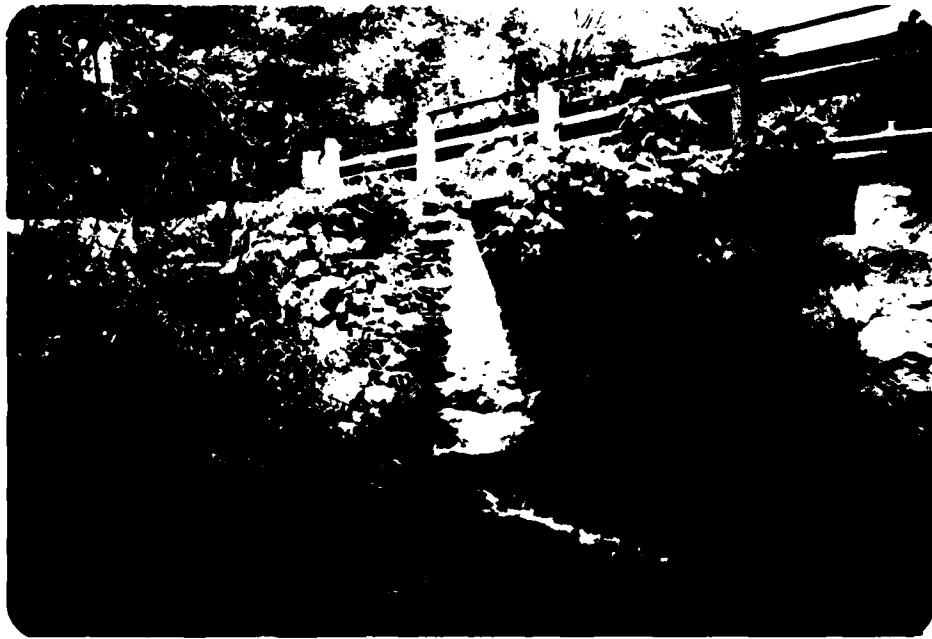


PHOTO C-3. Downstream face to right of the right spillway.

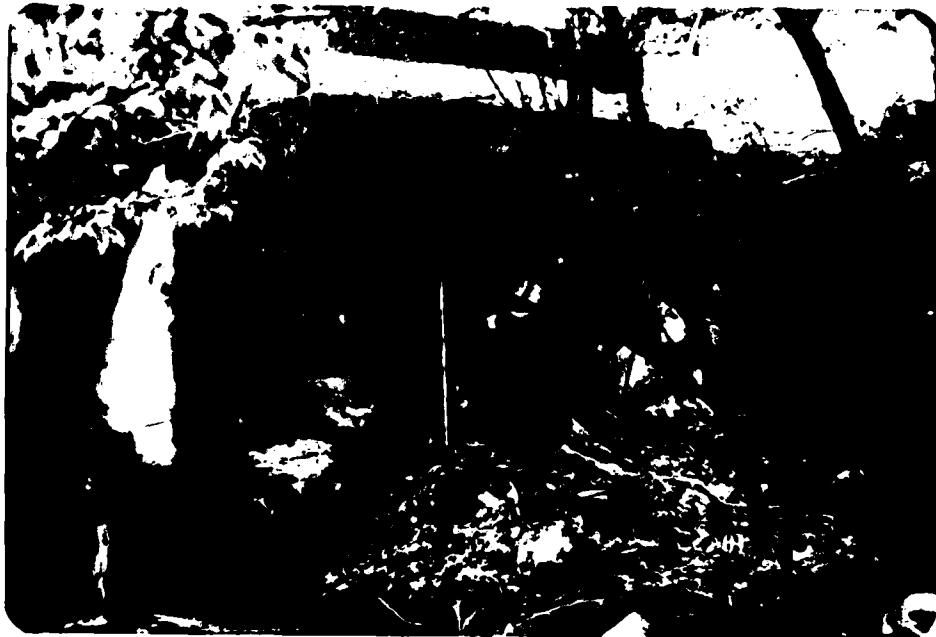


PHOTO C-4. Downstream face to the left of the left spillway.

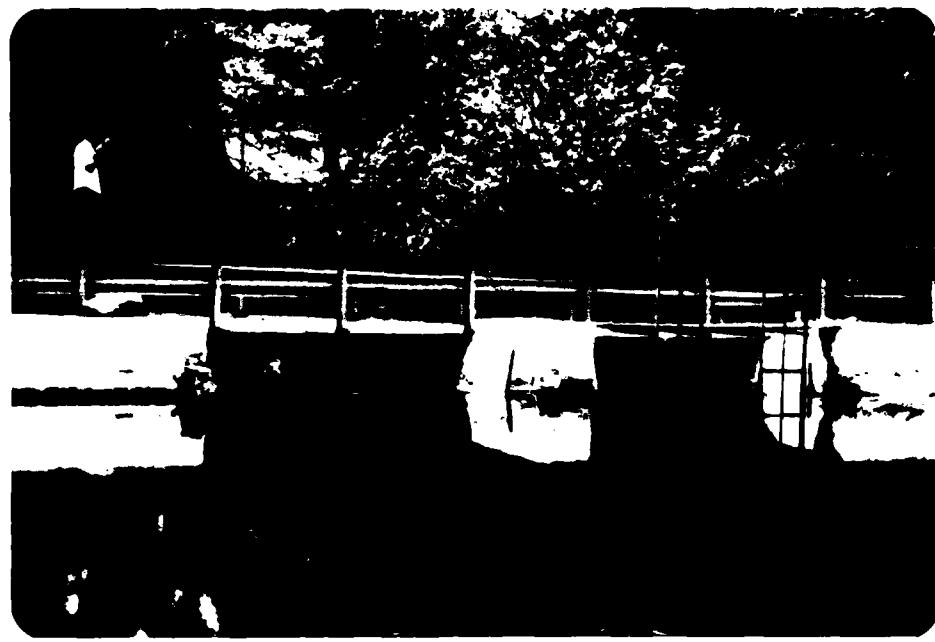


PHOTO C-5. Left and right spillways and outlet gates lifting mechanisms.



PHOTO C-6. Left and right spillways and spillway discharge channels.



PHOTO C-7. Intake to emergency overflow at the left abutment.



PHOTO C-8. Outlet of the emergency overflow at the downstream face.

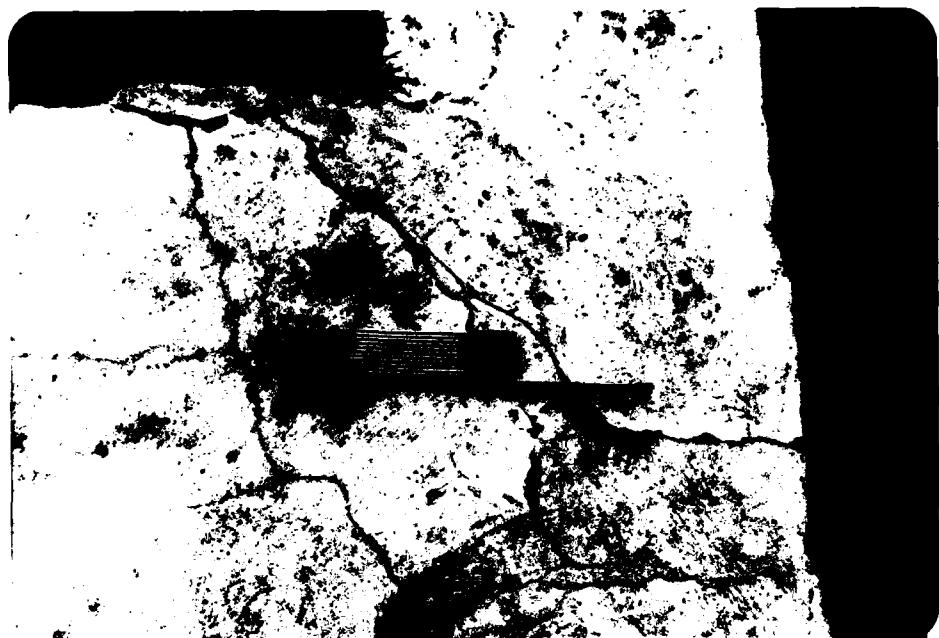


PHOTO C-9. Crack through training wall which divides the spillway discharge channels.



PHOTO C-10. Right side of training wall dividing spillway discharge channels from the downstream end. Note leakage from the left spillway discharge channel through training wall into right channel in center of photo.



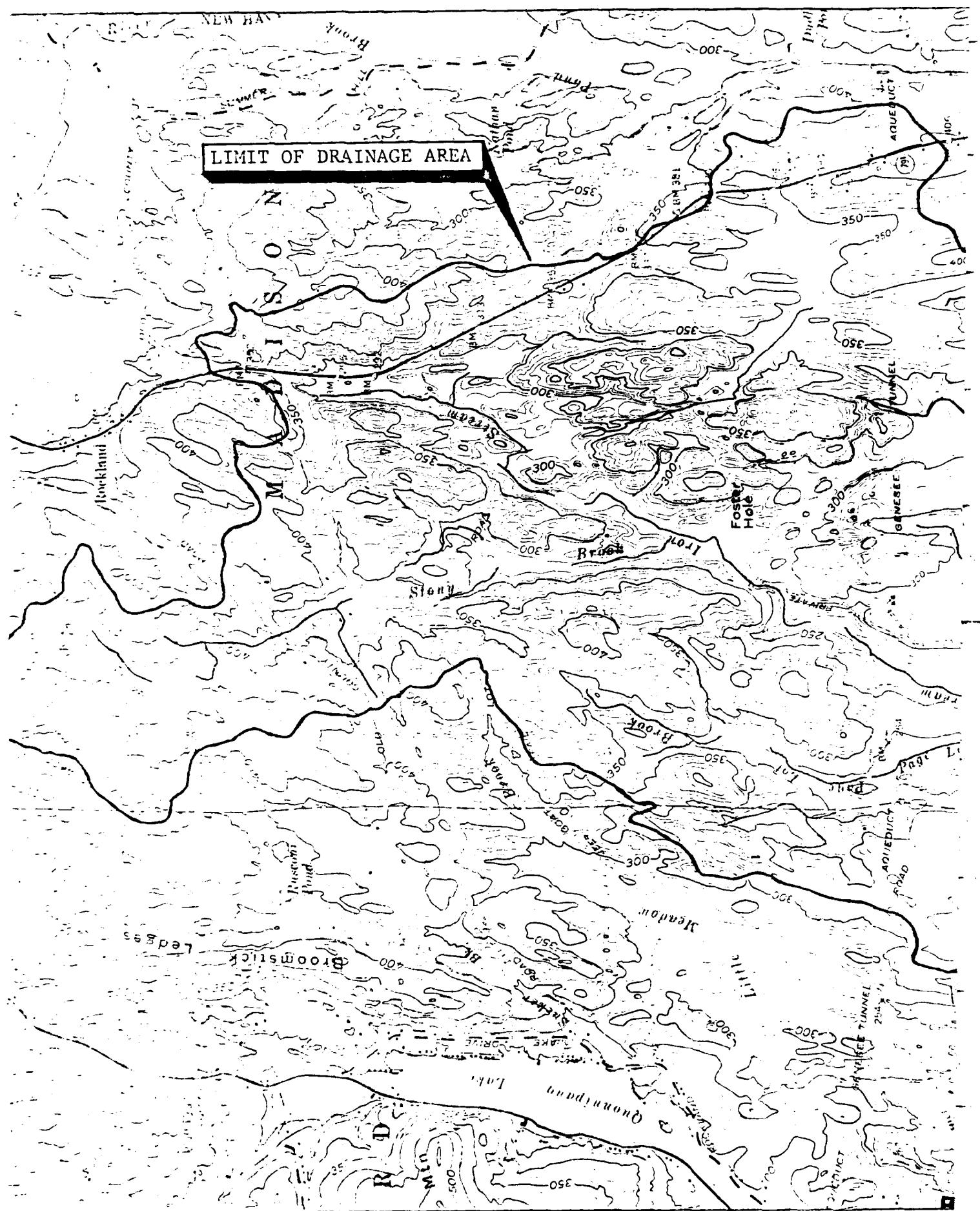
PHOTO C-11. Downstream channel from the end of the spillway discharge channels.

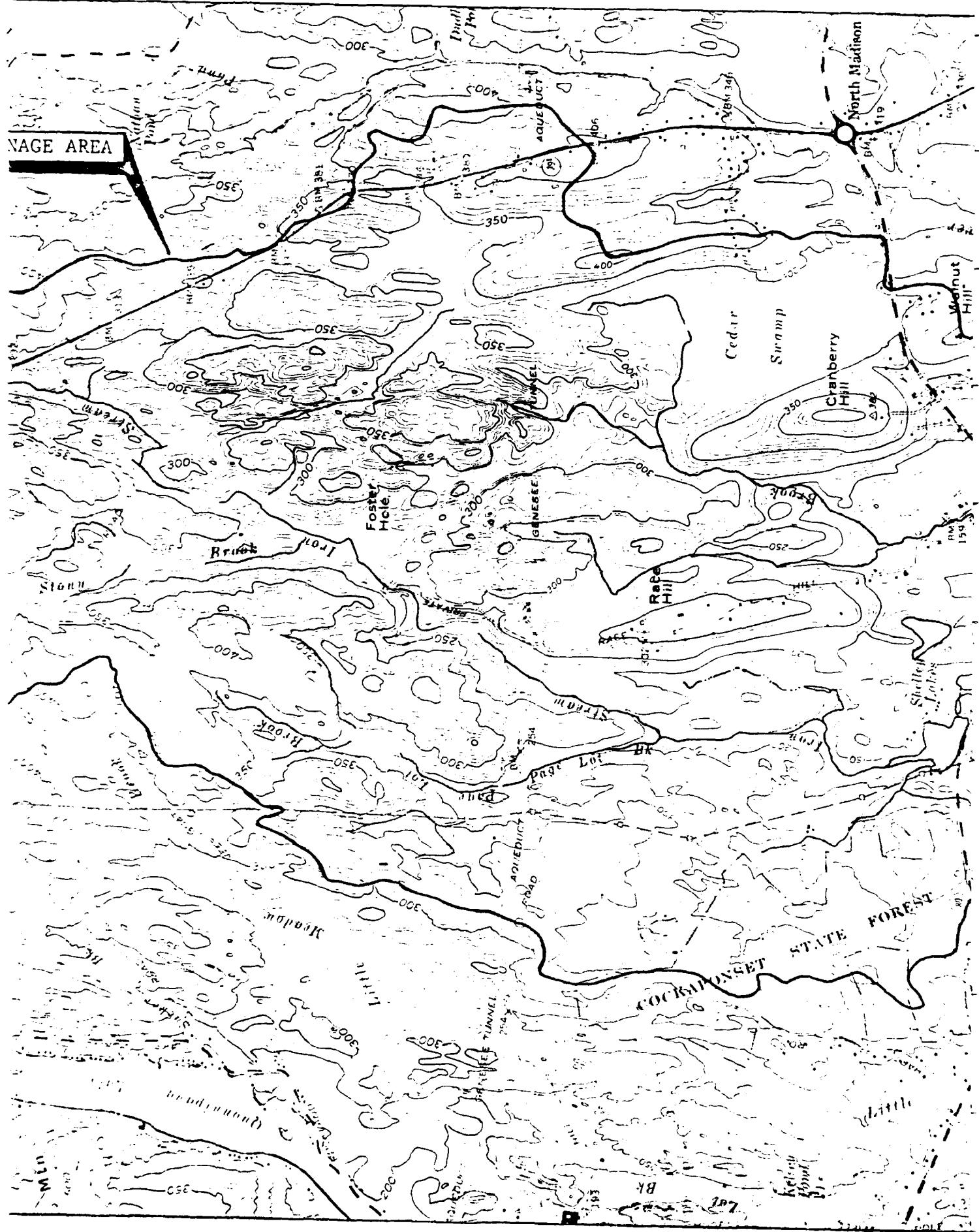


PHOTO C-12. View along crest from the left of the spillways showing bend in the upstream face.

APPENDIX D

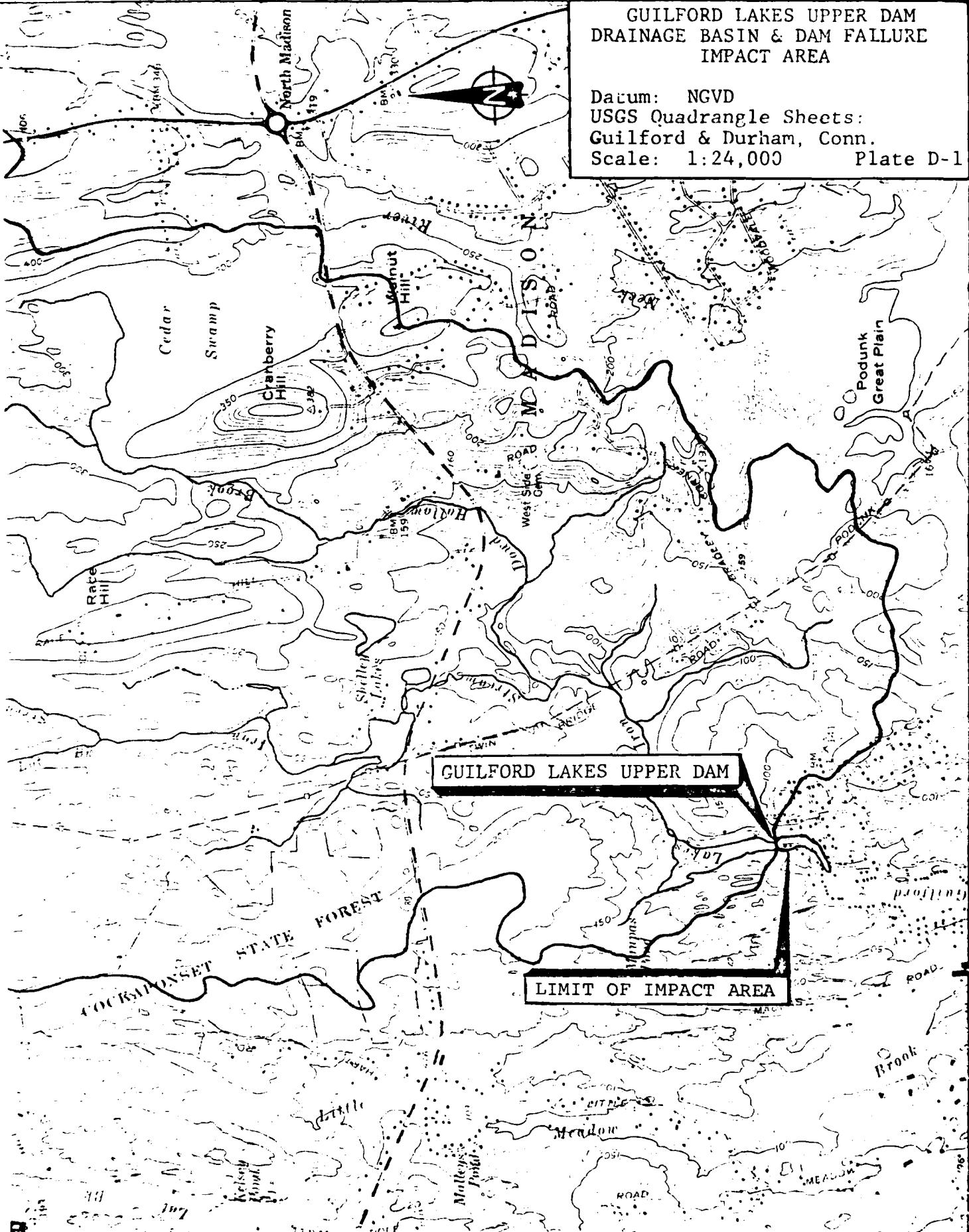
HYDROLOGIC AND HYDRAULIC COMPUTATIONS





GUILFORD LAKES UPPER DAM
DRAINAGE BASIN & DAM FAILURE
IMPACT AREA

Datum: NGVD
USGS Quadrangle Sheets:
Guilford & Durham, Conn.
Scale: 1:24,000 Plate D-1



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PROVIDENCE, R.I. 02903

Job No. Spillway Design - Providence, RI Sheet 1 of 0
Project Hydraulics Date 3/4/81
Subject Hydraulics By DC Chk by

BASIC DATA

DRAINAGE AREA = 10.4 SQ MI
SPILLWAY POOL ELEV. = 55.0 (ESTIMATED FROM USGS)
MAX POOL ELEV. = 55.3

RESERVOIR

@ SPILLWAY POOL - AREA = 10.0 ACRES
STORAGE = 50 AC-FT

@ MAX POOL - AREA = 10 AC
STORAGE = 83 AC-FT

DAM : EARTH EMBANKMENT
MAX HEIGHT = 12 FT
LENGTH = 200 FT

SPILLWAYS : LEFT - CONCRETE, TRAPEZOIDAL, FREE OVERFLOW
CREST = 54.9 NGVD
LENGTH = 17 FT

RIGHT - CONCRETE, BROADCRESTED
CREST = 55.0 NGVD
LENGTH = 13 FT

OUTLET - 2- 24" DIA. VC PIPES
INVERT = 50.05 NGVD
GATES: BECUE SLUICE GATES w/WORM
GEAR LIFTING MECH.

OVERFLOW - 2-15" DIA. VC PIPES
U.S. INVERT = 50.5
GATES = NONE
(LEFT PIPE CRUSHED & PLUGGED)

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Job No. GUILFORD LAKE - UPPER DAM

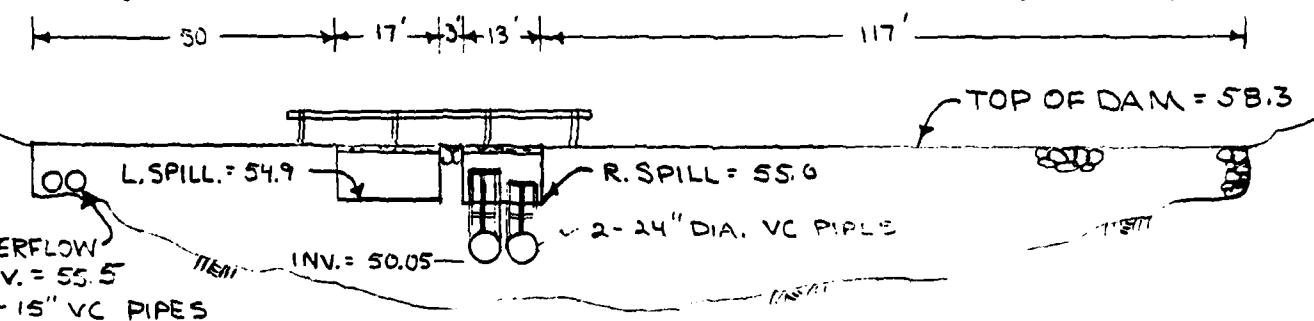
Project

Subject

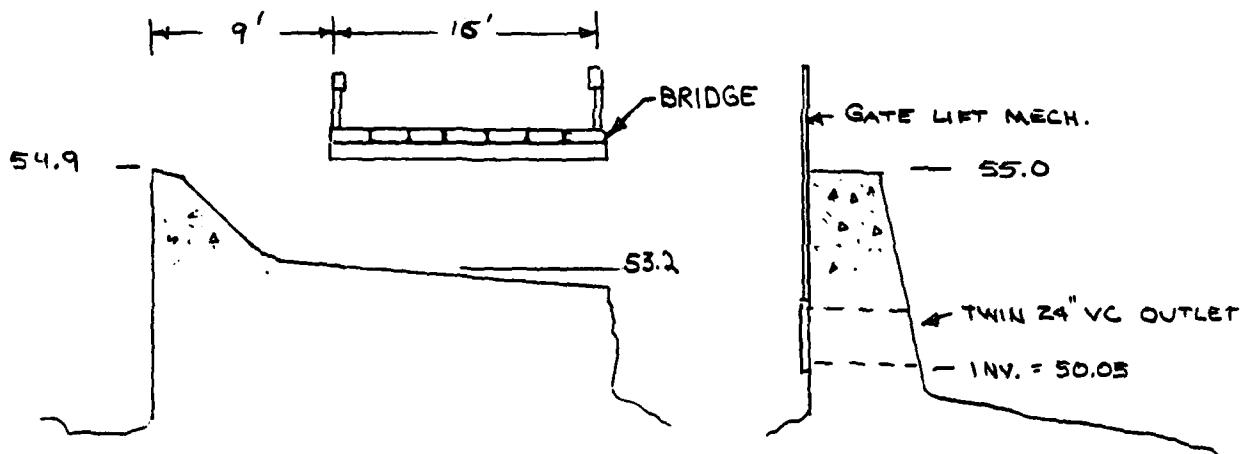
Sheet 2 of 9

Date 1/16/71

By C.R. by

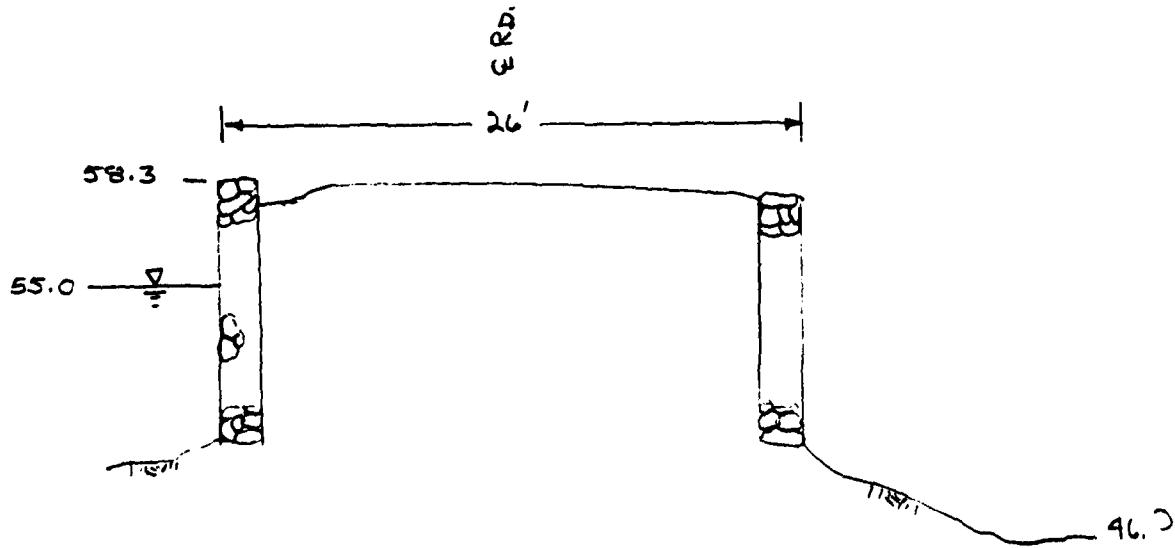


LONGITUDINAL SECTION THRU DAM - LOOKING DOWNSTREAM



LEFT SPILLWAY SECTION

RIGHT SPILLWAY SECTION



SECTION THROUGH DAM - STA 1+00

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Job No. SULFORD LAKES DIFF. P. S. M. Sheet 3 of 9
Project _____ Date 6/9/81
Subject _____ By DS Chk. by

CALCULATE TEST FLOOD

CLASSIFICATION: SMALL

HAZARD: HIGH

USE: $\frac{1}{2}$ PMF BASIN SLOPE = FLAT TO MODERATE

PMF = 1000 CSM \rightarrow REDUCE BY 15% FOR STORAGE

$$= 1000 \text{ CSM} \times .85 = 850 \text{ CSM}$$

$$\frac{1}{2} \text{ PMF} = 425 \text{ CSM}$$

$$\text{TEST FLOOD} = 10.4 \times 425 = 4420 \text{ CFS}$$

CALCULATE DAM RATING CURVE

$$\text{DAM \& SPILLWAY } Q = CLH^{3/2}$$

$$L. \text{ SPILL } C = 3.5 \quad L = 17 \text{ FT}$$

$$R. \text{ SPILL } C = 3.2 \quad L = 13 \text{ FT}$$

$$\text{DAM } C = 2.6 \quad L = 167 \text{ FT}$$

$$\text{OUTLET DISCHARGE} = CA\sqrt{2gH} - H \text{ FROM \& ORIFICE} \quad C = 0.6 \quad A = 6.28$$

$$\text{OVERFLOW } Q = CA\sqrt{2gH} \quad C = 0.6 \quad A = 1.2 \text{ (ONE PIPE)}$$

ELEV.	H _{spill}	Q	H _{outlet}	Q	H _{dam}	Q	H _{out}	Q	H _{over}	Q	ΣQ
56.0	1.1	70	1.0	40	-		5.0	70	-	-	180
57.0	2.1	180	2.0	120	-		6.0	75	3.9	5	390
58.3	3.4	375	3.3	250	-		7.3	80	2.2	10	715
59.0	4.1	495	4.0	335	1.0	435	8.0	85	2.9	11	1361
60.0	5.1	685	5.0	465	2.0	1230	9.0	90	3.9	12	2482
61.0	6.1	900	6.0	495	3.0	2225	10.0	95	4.9	14	3729
61.5	6.6	1010	6.5	690	3.5	2845	10.5	100	5.4	15	4660

@ TOP OF DAM = 58.3

SPILLWAY CAPACITY = 625 CFS

OUTLET CAPACITY = 80 CFS

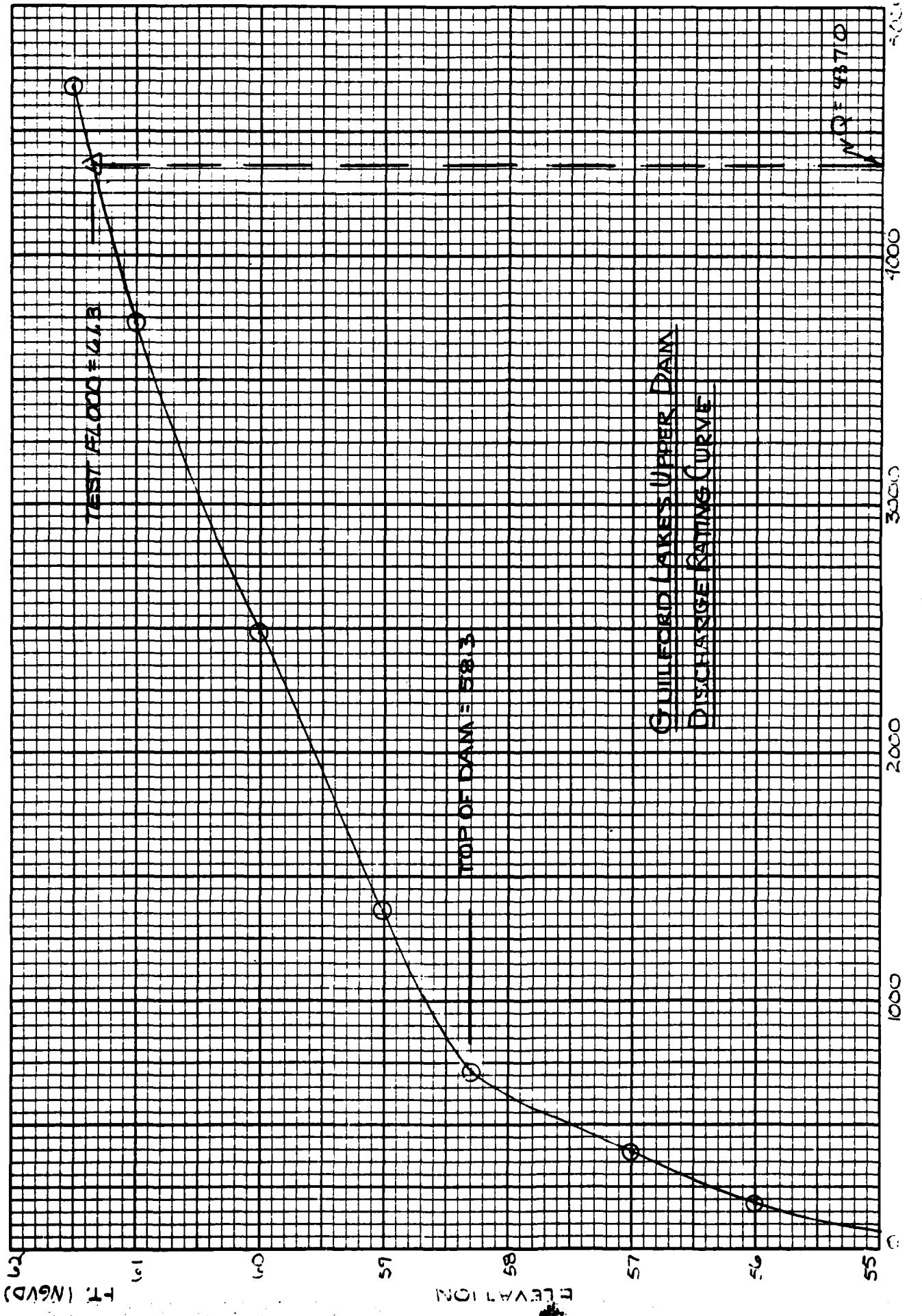
OVERFLOW = 10 CFS

@ TEST FLOOD = 61.3

SPILLWAY CAPACITY = 1620 CFS

OUTLET CAPACITY = 100 CFS

OVERFLOW CAPACITY = 15 CFS



4/9

CFS

5/9

CFS

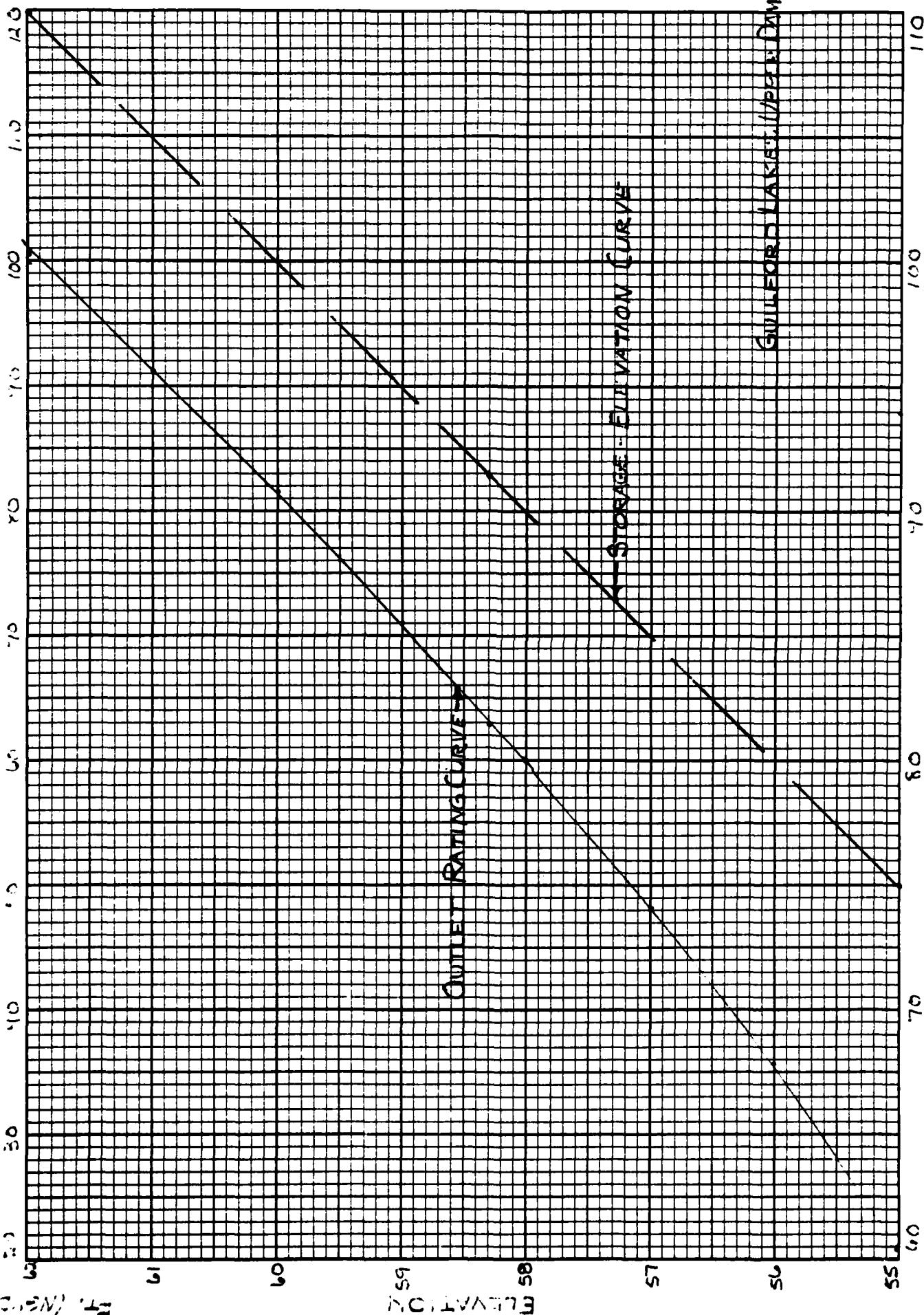
DISCHARGE

GUNNISON LAKE DAM

STORAGE - ELEVATION CURVE

OUTLET RATING CURVE

ELEVATION



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Job No. GUILFORD LAKES UPPER DAM Sheet 6 of 9
Project _____ Date 6/5/91
Subject _____ By DS Chk by

CALULATE EFFECT OF SURCHARGE STORAGE

PEAK INFLOW = 4420 CFS → SURCHARGE = 6.4 FT

$$V_s = \frac{6.4 \times 10 \text{ A.C.} \times 12}{10.4 \times 640} = .11 \text{ IN.}$$

$$Q_{PI} = \left(1 - \frac{.11}{9.5}\right) 4420 = 4370 \rightarrow \text{SURCHARGE} = 6.3 \text{ FT } \checkmark$$

1. SURCHARGE STORAGE WILL REDUCE THE TEST FLOOD INFLOW BY 50 CFS OR 1%
2. THE SPILLWAY CAN PASS 625 CFS OR 14% OF THE TEST FLOOD OUTFLOW
3. AT THE TEST FLOOD DISCHARGE OF 4370 CFS, THE DAM WILL BE OVERTOPPED BY 3.0 FT.

DAM FAILURE ANALYSIS

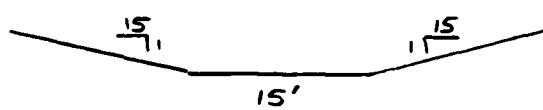
DAM FAILURE DISCHARGE = $8/27 W_0 V_g Y_0^{1.5}$ $Y_0 = 12 \text{ FT}$

USE BREACH WIDTH = 30 FT BASED ON HEIGHT & CROSS SECTION

$$Q_{FAIL} = \frac{8/27 (30) \sqrt{32.2} (12)^{1.5}}{3640 \text{ (SPILL. Q)}} = \frac{3000 \text{ CFS}}{3640 \text{ CFS}}$$

ESTIMATE DOWNSTREAM IMPACT

REACH = DAM TO GUILFORD LOWER LAKE $L = 1000 \text{ FT}$



$$n = 0.05$$
$$S_f = 0.007$$

TYPICAL SECTION FOR REACH

ESTABLISH RATING CURVE

STAGE	A	R ^{2/3}	Q
1.0	30	.76	55
2.0	90	1.13	250
3.0	180	1.43	640
4.0	300	1.70	1270
5.0	450	1.95	2182
6.0	630	2.18	3420
6.5	730	2.30	4175

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Job No. GUILFORD LAKE, UPPER DAM Sheet 7 of 9
Project _____ Date 2/5/81
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$$\begin{aligned} @ Q = 3640, \text{ STAGE} &= 6.3 \text{ FT. } A = 660 \\ @ Q = 440, \text{ STAGE} &= \frac{3.0}{3.3} \text{ FT } A = \frac{180}{480} \text{ (PREFAIL.)} \end{aligned}$$

$$\text{STOR}_1 = \frac{1000 \text{ FT} \times 480}{43560} = 11 \text{ AC-FT}$$

$$Q_{P1} = \left(1 - \frac{11}{83}\right) 3630 = 3150 \text{ CFS} \rightarrow \text{STAGE} = 5.9 \text{ FT } A = 610 \\ - \frac{180}{430}$$

$$\text{STOR}_2 = \frac{1000 \times 430}{43560} = 10 \text{ AC-FT } \text{STOR AVG} = 10.5 \text{ AC}$$

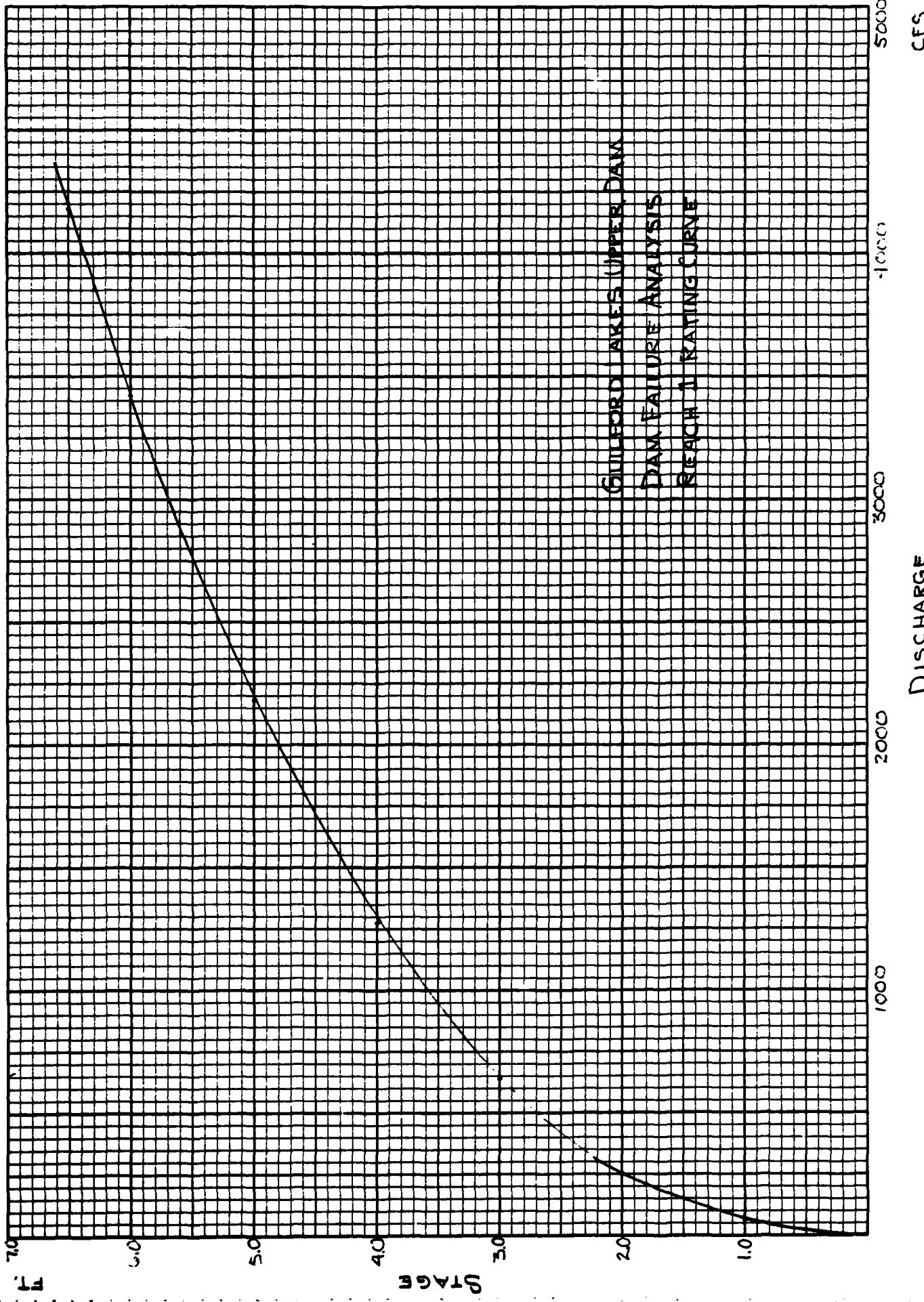
$$Q_{P2} = \left(1 - \frac{10.5}{83}\right) 3630 = 3170 \text{ CFS} \rightarrow \text{STAGE} = 5.9 \text{ FT.}$$

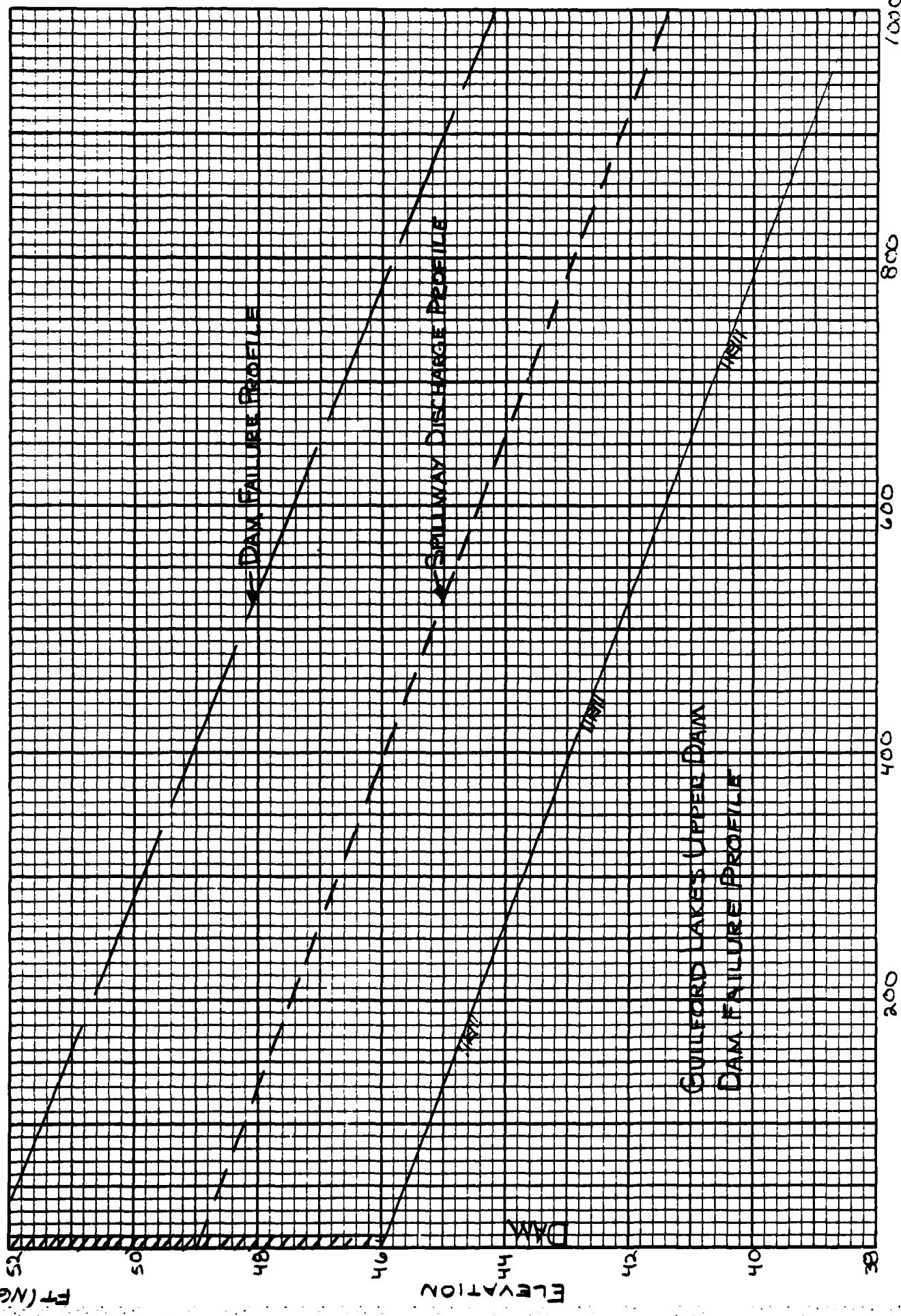
FAILURE FLOOD WAVE WILL BE STORED AT GUILFORD
LOWER LAKE WITH NO FURTHER DAMAGE

THERE ARE TWO HOMES LOCATED WITHIN FAILURE IMPACT
AREA APPROXIMATELY 200 FT DOWNSTREAM OF
THE DAM

1ST HOUSE DS = 4 FT ABOVE NORMAL W.S.
DEPTH OF FLOODING = 2-3 FT

2ND HOUSE DS = 6 FT ABOVE NORMAL W.S.
DEPTH OF FLOODING = 1-2 FT





APPENDIX E

INFORMATION AS CONTAINED IN THE NATIONAL
INVENTORY OF DAMS

NOT AVAILABLE AT THIS TIME

END

FILMED

10-84

DTIC